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Construction Noise & Vibration Management Plan

New Education Campus – Minarah College
268 – 278 Catherine Fields Road, Catherine Field, NSW

REPORT No
7280-1.3R Rev F

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Prepared For:
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1.0 INTRODUCTION

1.1 Overview

This Construction Noise and Vibration Management Plan has been prepared by Day Design Pty Ltd on behalf of the Minarah College (the Applicant). It accompanies an amended State Significant Development Application (SSDA) for the construction of a new school, Minarah College (the project) at 268-278 Catherine Fields Road, Catherine Field (the Site).

The legal description of the site is outlined in Table 1 below.

Table 1 Site Details

Property Address	Title Description
268 Catherine Fields Road	Lot 11 in DP 833983
278 Catherine Fields Road	Lot 12 in DP 833784
Site Area	4.50 ha

The Amended Development Report (**ADR**) was lodged with the Department of Planning, Housing and Infrastructure in September 2024. The amended SSDA sought consent for the construction of a co-educational establishment (Minarah College) accommodating 980 students.

The ADR was placed on public exhibition between 17 September 2024 and 28 October 2024. During this time approximately 400 submissions were received from special interest groups, members of the local community, individuals and Council. A further eight (8) submissions were received from NSW Agencies and public authorities.

This report has been prepared to address the Department's request for a written response to issues raised in the submissions, as required under section 59(2) of the Environmental Planning and Assessment Regulation 2021.

This Report specifically relates to the following key matters raised during public exhibition:

Item	Description of key issue	Response	Section Reference
Department of Planning, Housing and Infrastructure (DPHI)			
7. Noise	• The Construction Noise and Vibration Management Plan (CNVMP) concludes that predicted demolition, excavation and construction noise would exceed established noise levels provided in section 5.5. Recommended noise control mitigation measures provided in section 7.1 are detailed with provided dB noise reduction values of 3 control types. However, no comparative data between 'before noise controls and 'after noise control' is provided. • Provide details of noise exceedance levels after the application of noise controls and evaluate the effectiveness of the proposed noise control measures.	The assessment of construction noise and vibration emissions during the construction phase of the development are addressed in this CNVMP, including comparative data between 'before noise controls' and 'after noise controls'.	Sections 6 & 8
16. Documentation	**Noise reports:** • Inconsistencies across the Noise reports, design reports, architectural plans, staging report in regard to the heights of the sound barrier walls.	The ENIA and CNVMP have been updated to include information provided by the project manager to ensure consistency across all documents.	Sections 1 to 10 of the ENIA and Sections 1 to 9 of the CNVMP.
	• Roof plans per stage are requested to be provided that depict the heights of the sounds barrier walls around rooftop mechanical plant and equipment.	The assessment of noise impacts during the operational phase of the development are addressed in Day Design's 'Environmental Noise Impact Assessment' Report, Report No. 7280-1.2R Rev G, dated 8 May 2025, submitted as part of this application.	Sections 1 to 10 of the ENIA.

Item	Description of key issue	Response	Section Reference
Additional (DPHI) Comments (via email)			
	Inconsistencies with the heights of the noise walls identified in the Noise Impact Assessment and the heights recorded in the Staging Report, Architectural Reports and Design Report.	The ENIA and CNVMP have been updated to include information provided by the project manager to ensure consistency across all documents.	Sections 1 to 10 of the ENIA and Sections 1 to 9 of the CNVMP.
	Confirmation of the proposed operating hours of each component of the development. The operating hours of the Halls are recommended to be restricted between 9 am and 9:30 pm on page 116 of the Environmental Noise Impact Assessment (ENIA) report.	The ENIA and CNVMP have been updated to include information provided by the project manager to ensure consistency across all documents. Assessment of OSHC area included in this ENIA.	Sections 1 to 10 of the ENIA and Sections 1 to 9 of the CNVMP.
	The department have requested that the further information is provided on the type and intensity of the use of the sports field outside of school hours and that the traffic, WMA and Acoustic reports are reflective of the uses.	The ENIA and CNVMP have been updated to include information provided by the project manager to ensure consistency across all documents, including information about the type and intensity of the use of the sports field outside of school hours	Sections 1 to 10 of the ENIA and Sections 1 to 9 of the CNVMP.
Camden Council			
Noise Impact	***Noise associated with school operation*** The Environmental Noise Impact Assessment Report submitted as part of the Amended SSDA demonstrates that acoustic compliance is only achieved during Stage 1 of the development. To reduce the acoustic impact on the neighbouring residential receivers, acoustic walls ranging from 1.5 m to 2.4 m are required within the proposed school and along the boundary. The proposed acoustic walls, which	The assessment of noise impacts during the operational phase of the development are addressed in Day Design's 'Environmental Noise Impact Assessment' Report, Report No. 7280-1.2R Rev G, dated 8 May 2025, submitted as part of this application.	Sections 1 to 10 of the ENIA

Item	Description of key issue	Response	Section Reference
	includes a 1.8 m to 2 m high colorbond fence extending along the entire length of the side and rear property boundaries, will have a negative impact on the visual amenity of the surrounding rural landscape. Furthermore, despite the proposed acoustic walls and façade treatments, the acoustic amenity of at least three residential receivers will be impacted by children during outdoor play by +1 dB to +6 dB.		
	Construction noise The Construction Noise & Vibration Management Plan submitted as part of the Amended SSDA outlines the noise emissions from works to be undertaken over the various stages of the proposed development. The main source of noise will be from heavy machinery such as excavators, dump trucks, cranes, cement mixers and rock breakers. Noice exceedances (without controls) for residential receivers range from +3 dB up to +40 dB. Section 7.2 of the Report outlines noise management controls aimed at managing the impacts on neighbours and include: • Periods of respite – noisy construction activities only operate for 2 to 3 hours at a time. • Work practices – workers and contractors be trained in work practices to minimise noise emissions. • Heavy vehicles and staff vehicles – keep truck drivers informed of designated vehicle	The assessment of construction noise and vibration emissions during the construction phase of the development are addressed in this CNVMP, including comparative data between 'before noise controls' and 'after noise controls'. Day Design advise that all reasonably practical noise control recommendations were considered in Section 7.0 of this CNVMP in accordance with Australian Standard AS2436:2010 "Guide to noise and vibration control on construction, demolition and maintenance sites" and the EPA's Interim Construction Noise Guideline 2009 and Assessing Vibration: a technical guideline 2006.	Sections 6, 7 & 8

Item	Description of key issue	Response	Section Reference
	routes, parking location, acceptable delivery hours etc. • Community relations – a Community Liaison Officer be appointed to ensure communication is maintained with neighbours prior to and throughout the construction process. • Managing a noise complaint – the Community Liaison Officer should receive and manage all noise complaints. Despite the proposed controls, acoustic exceedances will still be encountered by several adjoining residential receivers. Based on the proposed timeframes for the construction of the four stages of the development, it is unreasonable for the acoustic amenity of residents to be impacted for a period of approximately 3.3 years. Furthermore, given the proposed 'periods of respite' (to limit noise generating construction works to 2 to 3 hours a day), it is likely that development works will take longer than the timeframe(s) outlined in Section 4.2 of the report.		
	Overall, the proposed development is considered to have an unreasonable impact on the amenity of the surrounding area, both during construction and ongoing operation.	In accordance with the requirements of the SEPP *(Transport and Infrastructure) 2021* for the ENIA, and Australian Standard AS2436:2010 *"Guide to noise and vibration control on construction, demolition and maintenance sites"* and the EPA's *Interim Construction Noise Guideline 2009* and *Assessing Vibration: a*	Sections 1 to 10 of the ENIA and Sections 1 to 9 of the CNVMP.

Item	Description of key issue	Response	Section Reference
		technical guideline 2006 for the CNVMP, reasonable and feasible mitigation measures have been recommended within the ENIA and CNVMP with **consideration to the acoustic amenity of adjacent developments and the local neighbourhood**.	

This Report concludes that the proposed educational establishment as amended is suitable and warrants approval subject to the implementation of the mitigation measures recommended in Section 7.0.

Following the implementation of the above mitigation measures, the remaining impacts are appropriate.

1.2 The Proposal

The amended application seeks consent for the construction of a co-educational establishment (Minarah College) accommodating 980 students. The school will comprise of an Early Learning Centre (ELC) for 60 students, a School for Specific Purpose (SSP) for 30 students, a primary school accommodating 505 students and a high school for 385 students. The new school will be constructed in four stages, growing in line with growth in the local population. Specifically, consent is sought for:

- Demolition of the existing dwellings and ancillary structures on-site;
- Bulk earthworks across the site;
- The construction of the following:
    - One-storey early learning centre;
    - Two-storey administration building, with attached outside school hours care (OSHC), and wellbeing room;
    - Two-storey primary school building comprising of primary school classrooms;
    - School for Specific Purpose classrooms;
    - Primary school hall;
    - Two-storey high school building comprising high school classrooms;
    - Two-storey high school hall;
    - Shared one-storey canteen adjoining the high school building;
    - Shared library located on the second storey above the ELC and Food and Textiles building below; and
    - A full sized sport field.
- Site access from Catherine Fields Road at two points;
- Works within Catherine Fields Road to allow for a right-turn bay from Catherine Fields Road and bus bays on the eastern side of Catherine Fields Road;
- Removal of trees and replacement planting and landscaping;
- Associated site landscaping and public domain improvements;
- On-site car parking; and
- Construction of ancillary infrastructure and utilities as required.

The development is to be constructed in four stages. The school will be operating at full capacity from stage 3. A breakdown of the student and staff numbers across each stage is as follows:

- Stage 1: 2026, 318 students (18 ELC, 290 School, 10, SSP), 15 FTE staff;
- Stage 2: 2031, 652 students (42 ELC, 600 School, 10 SSP), 33 FTE Staff;
- Stage 3, 2035, 980 students (60 ELC, 890 School, 30 SSP), 51 FTE Staff;

  - Stage 4, 2037, 980 students (60 ELC, 890 School, 30 SPP), 51 FTE Staff

- The total student population at stage 3 will be 980 students, the staff population will total 45 FTE and 6 SSP staff.

The purpose of this Construction Noise and Vibration Management Plan is to assess the potential noise and vibration impact during the construction phase of the proposal on the acoustic amenity of the adjacent developments and the local neighbourhood.

1.3 The Site

The site is located at 268-278 Catherine Fields Road, Catherine Field, Dharawal Country, NSW and is legally described as Lot 11 in DP 833983 and Lot 12 in DP 833784. The site is located within Camden local government area (LGA) and has a site area of approximately 4.50 ha.

The site is in a typical large lot rural residential subdivision area. The site has a gentle fall from the east to west with a minor ridgeline along the east to west axis. Diagonal falls lead to the southwest and north west areas of the site. The northern and eastern boundaries of the site are characterised by remnant regenerating bushland, whilst majority of the site is former pastureland with sparsely scattered trees.

Both lots contain rural residential dwellings with ancillary farm structures including numerous sheds, farm buildings and water tanks. Lot 11 contains two prominent dams.

Figure 1 – Site Context Map 1

Figure 2 – Site Context Map 2

1.4 Response to SEARS

The Construction Noise and Vibration Management Plan is required by the Secretary's Environmental Assessment Requirements (SEARs) for **SSD-30759158**. This table identifies the SEARs and relevant reference within this report.

Table 2 SEARS & Relevant Reference

SEARs Item	Report Reference
11. Noise and Vibration • *Provide a noise and vibration assessment prepared in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines. The assessment must detail construction and operational noise (including any public-address system, events, and out of hours use of school facilities) and vibration impacts on nearby sensitive receivers and structures, considers noise intrusion, and outline the proposed management and mitigation measures that would be implemented.*	*See Sections 2.0 to 9.0 of this report for operational noise assessment.* *The assessment of noise impacts during the operational phase of the development are addressed in Day Design's 'Environmental Noise Impact Assessment' Report, Report No. 7280-1.2R Rev G, dated 8 May 2025, submitted as part of this application.*

2.0 EXECUTIVE SUMMARY

Minarah College propose to submit an amended State Significant Development Application (SSDA) to construct a new education campus, to be known as the Minarah College (the College) at 268-278 Catherine Fields Road, Catherine Field, NSW (the Site).

The Site is situated on land zoned *RU4: Primary Production Small Lots* under Camden Local Environmental Plan (CLEP) 2010, and comprises of two Lots being Lot 11 in DP 833983 (268 Catherine Fields Road) and Lot 12 in DP 833784 (278 Catherine Fields Road). Each of the Lots currently contain a residential dwelling, with associated sheds and auxiliary structures.

The Site is bounded by land zoned *RU4: Primary Production Small Lots* to the north, east and west, and *R5: Large Lot Residential* to the south. Residential dwellings are located on the Lots to the north, north-east, south and west (on the opposite side of Catherine Fields Road). The Lots to the east of the Site contain light industrial type buildings.

The proposal seeks approval for the following:

- Demolition of the existing structures on 268 and 278 Catherine Fields Road;
- Four stage construction of an independent Islamic co-educational school catering for 980 students from Kindergarten to Year 12, consisting of:
    - 505 place Primary School (PS) with school hall;
    - 385 place High School (HS); and
    - 30 place School for Specific Purposes (SSP) – 15 place PS & 15 place HS.
- Construction of a 60 place Early Learning Centre (ELC); and
- Construction of shared facilities including – administration building with offices and staff break-out areas, amenities, multi-purpose hall, COLA, landscaped outdoor areas, resource centre (library), sports field, parking areas and drop off/pick up area/ driveway.

The construction will include the removal of existing structures, excavation of the site and the construction of the new Minarah College buildings. The proposed hours of construction are during standard working hours.

The proposal is a State Significant Development (*SSD-30759158*) and has been issued by the NSW Department of Planning and Environment with the Secretary's Environmental Assessment Requirements (SEARs). The SEARs require an assessment against the NSW Environment Protection Authority's (EPA) *Interim Construction Noise Guideline 2009* and *Assessing Vibration: a technical guideline 2006.*

This construction noise and vibration management plan has been prepared in accordance with the Australian Standard AS2436:2010 *"Guide to noise and vibration control on construction, demolition and maintenance sites"*. Construction noise and vibration management levels have been derived from the Environment Protection Authority's *Interim Construction Noise Guideline 2009* and *Assessing Vibration: a technical guideline 2006* and are used for a quantitative assessment at the nearest affected residential receiver locations.

The major noise sources associated with the project are mobile plant and machinery to be used during the excavation and bulk earth works including rock hammering (if required) and the transport of raw materials to and from site in trucks.

There is potential, at least on some occasions, for noise emission from construction works to exceed the noise management level at some residences during various stages of the works.

All feasible and reasonable methods to reduce noise emissions and minimise the noise impact on neighbouring properties have been provided in Section 7 of this report. These include, limiting construction activity to within the prescribed hours, selecting quiet equipment, incorporating periods of respite, maintaining community consultation relations, managing noise complaints and conducting ground-borne vibration monitoring (if necessary).

Provided the recommendations in Section 7 of this report are implemented and adhered to, the level of noise and vibration from the construction works will be minimised in accordance with Australian Standard AS2436:2010 and the NSW Environment Protection Authority's *Interim Construction Noise Guideline 2009* and *Assessing Vibration: a technical guideline 2006*.

3.0 CONSULTING BRIEF

Day Design Pty Ltd has been engaged by Midson Group on behalf of Minarah College to prepare a Construction Noise and Vibration Management Plan for the proposed new education campus to be known as Minarah College at 268-278 Catherine Fields Road, Catherine Field, NSW.

This commission involves the following:

Scope of Work:

- Inspect the site and environs
- Measure the background noise levels at critical locations and times
- Establish acceptable noise level criterion
- Quantify noise emissions from the demolition, excavation and construction works
- Calculate the level of noise emission, taking into account distance attenuation
- Prepare a site plan identifying the development and nearby noise sensitive locations
- Provide recommendations for noise control (if necessary)
- Prepare a Construction Noise and Vibration Management Plan.

4.0 PROJECT DESCRIPTION

4.1 Site Description

The Site is situated on land zoned *RU4: Primary Production Small Lots* under Camden Local Environmental Plan (CLEP) 2010, and comprises of two Lots being Lot 11 in DP 833983 (268 Catherine Fields Road) and Lot 12 in DP 833784 (278 Catherine Fields Road). Each of the Lots currently contain a residential dwelling, with associated sheds and auxiliary structures.

The Site is bounded by land zoned *RU4: Primary Production Small Lots* to the north, east and west, and *R5: Large Lot Residential* to the south. Residential dwellings are located on the Lots to the north, north-east, south and west (on the opposite side of Catherine Fields Road). The Lots to the east of the Site contain light industrial type buildings.

The nearest noise sensitive receptors to the Site, in various directions, are shown on Figure 3 and as follows in Table 3.

Table 3 Noise Sensitive Receptors

Receptor and Type	Address	Direction from site
R1 – Residential	286 Catherine Fields Rd	North
R2 – Residential	227-235 Deepfields Rd	North-East
R3 – Light Industrial	225 Deepfields Rd	East
R4 – Residential	16 Heatherfield Cl	South
R5 – Residential	14 Heatherfield Cl	South
R6 – Residential	12 Heatherfield Cl	South
R7 – Residential	260 Catherine Fields Rd	South
R8 – Residential	265 Catherine Fields Rd	South-West
R9 – Residential	271 Catherine Fields Rd	West
R10 – Residential	277 Catherine Fields Rd	West
R11 – Residential	285 Catherine Fields Rd	North-West
RE – Educational	Minarah College Educational Buildings	All

Figure 3 - Location Plan, 268 – 278 Catherine Fields Road, Catherine Field, NSW.

4.2 Development Description

The development process is broken down into three phases:

- Phase 1 – Demolition of the existing buildings (Stage 1 only):
    - Expected timeframe of 2 weeks
    - Activities include use of excavator and dump trucks.
- Phase 2 – Excavation and earth moving (Stages 1 to Stage 4)
    - Expected timeframe of 4 weeks
    - Activities include use of excavator and dump trucks, a pile bore and a rock breaker as required.
- Phase 3 – Construction (Stages 1 to 4)
    - Expected timeframe:
        - Stage 1 52 weeks;
        - Stage 2 40 weeks;
        - Stage 3 40 weeks;
        - Stage 4 40 weeks.
    - Activities include use of cement trucks, cranes, gensets, and hand tools.

The staging plan for the project is attached in Appendix C.

The proposed and allowable hours of construction works, including delivery of materials to and from the site, are as follows:

- Monday to Friday: 7 am to 6 pm;
- Saturdays: 8 am to 1 pm; and
- Sundays and public holidays: No work.

5.0 NOISE CRITERIA

5.1 Measured Ambient Noise Level

In order to assess the severity of a possible environmental noise problem in a residential area it is necessary to measure the ambient background noise level at the times and locations of worst possible annoyance. The lower the background noise level, the more perceptible the intrusive noise becomes and the more potentially annoying.

The ambient L_{90} background noise level is a statistical measure of the sound pressure level that is exceeded for 90% of the measuring period (typically 15 minutes).

The Rating Background Level (RBL) is defined by the Environment Protection Authority (NSW) as the median value of the (lower) tenth percentile of L_{90} ambient background noise levels for day, evening or night periods, measured over a number of days during the proposed days and times of operation.

The places of worst possible annoyance are the nearby residential dwellings. These locations are shown in the Site Plan on Figure 3 as 'R1' to 'R2' and 'R4' to 'R11'. The times of worst possible annoyance will be during the day when the construction is occurring.

Ambient noise levels were measured in 278 and 268 Catherine Fields Road, shown as Locations 'A' and 'B', respectively, on Figure 3, for the following periods:

- Location 'A'
    - Friday 15 October to Friday 22 October 2021.
- Location 'B'
    - Wednesday 25 August to Wednesday 1 September 2021;
    - Thursday 2 September to Friday 10 September 2021; and
    - Friday 15 October to Friday 22 October 2021.

Note, a noise logger was placed near Location 'A' (circa 25 meters to the north) on Wednesday 25 August 2021. During an inspection on 2 September 2021 to replace the batteries, it was discovered the noise logger had been removed by a third party – at the time of writing this report, the noise logger and associated data have not been recovered.

The day time ambient noise levels are presented in the attached Appendix B1, B2, B3 and B4, and also below in Table 4.

Table 4 Ambient Noise Levels – 268 – 278 Catherine Fields Rd, Catherine Field

Noise Measurement Location	Date & Time Period	L_{90} Rating Background Level	Existing L_{eq} Noise Level
Location 'A' - 278 Catherine Fields Road	*15/10 to 22/10/2021* Day (7 am to 6 pm)	**39 dBA**	**60 dBA**
Location 'B' - 268 Catherine Fields Road	*25/08 to 01/09/2021* Day (7 am to 6 pm)	**36 dBA**	**49 dBA**
	2/09 to 10/09/2021 Day (7 am to 6 pm)	**38 dBA**	**49 dBA**
	15/10 to 22/10/2021 Day (7 am to 6 pm)	**36 dBA**	**51 dBA**
	25/08 to 01/09/2021, 2/09 to 10/09/2021 & 15/10 to 22/10/2021 Day (7 am to 6 pm)	**36 dBA**	**50 dBA**

Meteorological conditions during the monitoring typically consisted of clear skies. Where applicable, rain or wind affected data has been removed from the assessment period. Temperatures ranged from 2 to 27°C from *25/08 to 01/09/2021,* 0 to 28°C from *2/09 to 10/09/2021* and 7 to 27°C from *15/10 to 22/10/2021*. Atmospheric conditions were generally ideal for noise monitoring. Noise measurements were therefore considered reliable and typical for the receptor areas. Meteorological data was gathered from weather station ID 068192 (Camden Airport AWS NSW) circa 9.13 kms away.

Fact Sheet A: Determining existing noise levels, Section A1 of the NPI states the following in relation to determining background noise levels:

Background noise levels need to be determined before intrusive noise can be assessed. The background noise levels to be measured are those that are present at the time of the noise assessment and without the subject development operating. For the assessment of modifications to existing premises, the noise from the existing premises should be excluded from background noise measurements. The exception is where the premises has been operating for a significant period of time and is considered a normal part of the acoustic environment; it may be included in the background noise assessment under the following circumstances:

- *the development must have been operating for a period in excess of 10 years in the assessment period/s being considered and is considered a normal part of the acoustic environment; and*

- *the development must be operating in accordance with noise limits and requirements imposed in a consent or licence and/or be applying best practice.*

Therefore, considering the above, ambient noise measurements should include the noise contribution from the nearby light industrial premises and local agriculture within the local area, as it forms part of the existing acoustic environment – noise from the operation of industrial premises and local agriculture is typical/expected in this area.

Section B1.1 'Instrument requirements and siting', paragraph 2 of the *NPI* requires monitoring to take place at a 'site that is truly representative of the noise environment at the residence'. A representative location with a similar noise environment was selected to conduct the ambient noise measurements on the Site, being adjacent to the potentially and reasonably most affected receiver locations.

Section B1.2 'Measurement procedure', point 2, of the *NPI* specifies that monitoring should take place for 'each day of the week the proposed development will be operating and over the proposed operating hours'.

Section B1.3, under 'Exception' states, '*re-monitoring may not be required, where monitoring contains weather-affected data, if it can be ascertained that the affected samples are not within the expected 'quieter' times of an assessment period (day/evening/night); that is, those time periods where the lowest 10th percentile background noise level might occur.'* Detailed analysis of the weather affected data, shown in Appendix B1 to B4, concluded that majority of the 10th percentile background noise levels occurred during the quieter time periods – being 7 am to 9 am Saturday and Sunday and 9 am to 3 pm Monday to Friday - and were not affected by adverse weather.

In accordance with Fact Sheet A and Fact Sheet B of the NPI, Day Design is of the opinion the measured RBLs in Location 'B' are representative of the noise environment at the most affected residential receivers 'R1' to 'R2' and 'R4' to 'R11', and have been adopted as the assessment RBLs in this report.

5.2 NSW Department of Planning & Environment

The NSW Department of Planning and Environment (DoPE) issued the Planning Secretary's Environmental Assessment Requirements (SEARs) for the preparation of an Environmental Impact Statement (EIS) for the Minarah College development, 268-278 Catherine Fieldes Road, Catherine Field, NSW (*SSD -30759158, 29 October 2021*). As part of the SEARs, the following requirements relating to acoustics must be satisfied:

'11. Noise and Vibration

> *Provide a noise and vibration assessment prepared in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines. The assessment must detail construction and operational noise (including any public-address system, events, and out of hours use of school facilities) and vibration impacts on nearby sensitive receivers and structures, considers noise intrusion, and outline the proposed management and mitigation measures that would be implemented.'*

Relevant Policies and Guidelines:

- Interim Construction Noise Guideline (DECC);
- Assessing Vibration: A Technical Guideline 2006.

Noise emissions from the operational phase of the development are addressed in Day Design's 'Environmental Noise Impact Assessment' Report, Report No. 7280-1.2R Rev G, dated 8 May 2025, submitted as part of this amended application.

5.3 Australian Standard AS2436

The Australian Standard AS2436:2010 *"Guide to noise and vibration control on construction, demolition and maintenance sites"* provides guidance on noise control in respect to construction, demolition and maintenance sites. The Standard also provides guidance for the preparation of noise and vibration management plans.

Section 1.5 'Regulatory Requirements' of the Standard states:

"Legislation associated with the control of noise and vibration on and from construction, demolition and maintenance sites in Australia is generally the responsibility of the relevant State or Territory government, local council or a designated statutory authority."

Consequently the Standard does not provide specific noise criterion rather sets out practical methods for determining the potential for noise and vibration impact on the community from construction, demolition and maintenance sites.

A qualitative method is described in Section 3.3 of the standard, which is designed to avoid the need for complex noise predictions by following a series of questions relating to, for example, whether the noise is likely to be loud, have annoying characteristics or affect sleep.

In the event that any of these outcomes are likely, a more detailed and quantitative approach should be adopted.

In relation to carrying out detailed noise impact assessments, Section 4 'General' of the standard states:

"Regulatory authorities may have relevant polices and/or guidelines for the control of noise and vibration on construction sites. These should also be referred to when developing noise and vibration management plans for such projects."

In NSW this is the NSW Environment Protection Authority's *Interim Construction Noise Guideline 2009* as outlined in Section 5.4.

The Standard further states, in Section 4.6.1, that if noisy processes cannot be avoided, then the amount of noise reaching the receiver should be minimised and goes on to provide advice and recommendations to reduce noise and vibration impacts as far as reasonably practicable.

This report has been prepared in accordance with the guidance provided in AS2436:2010.

5.4 NSW Environment Protection Authority

5.4.1 EPA Construction Noise Guideline

The NSW Environment Protection Authority published the *Interim Construction Noise Guideline* in July 2009. While some noise from construction sites is inevitable, the aim of the Guideline is to protect the majority of residences and other sensitive land uses from noise pollution most of the time.

The Guideline presents two ways of assessing construction noise impacts; the quantitative method and the qualitative method.

The quantitative method is generally suited to longer term construction projects and involves predicting noise levels from the construction phase and comparing them with noise management levels given in the guideline.

The qualitative method for assessing construction noise is a simplified way to identify the cause of potential noise impacts and may be used for short-term works, such as repair and maintenance projects of short duration.

In this instance, the quantitative method is the most appropriate and has been used in this assessment. Details of the quantitative method are given in Section 4 of the Guideline.

Normal construction hours are defined by the EPA as follows:

- 7.00 am to 6.00 pm Monday to Friday;
- 8.00 am to 1.00 pm Saturday; and
- No work on Sunday or Public Holiday.

Table 2 in Section 4 of the Guideline sets out noise management levels at affected residences and how they are to be applied during normal construction hours. The noise management level is derived from the rating background level (RBL) plus 10 dB in accordance with the Guideline. This level is considered to be the 'noise affected level' which represents the point above which there may be some community reaction to noise.

The 'highly noise affected' level of 75 dBA represents the point above which there may be strong community reaction to noise. This level is provided in the Guideline and is not based on the RBL. Restrictions to the hours of construction may apply to activities that generate noise at residences above the 'highly noise affected' noise management level.

Based on the RBLs at all sensitive residential receiver locations in the daytime, the recommended noise management level during all aspects of the construction program are summarised in Table 5.

Table 5 L_{eq} Noise Management Levels from Construction Activities

Receptor Location	Noise Management Level	How to Apply
All Residential Receptors	**46 dBA (36 + 10)**	The noise affected level represents the point above which there may be some community reaction to noise. ▪ Where the predicted or measured $L_{Aeq\ (15\ min)}$ noise level is greater than the noise affected level, the proponent should apply all feasible and reasonable* work practices to meet the noise affected level. ▪ The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. ▪ Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences); 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

*Section 6, 'work practices' of The *Interim Construction Noise Guideline*, states: *"there are no prescribed noise controls for construction works. Instead, all feasible and reasonable work practices should be implemented to minimise noise impacts. This approach gives construction site managers and construction workers the greatest flexibility to manage noise"*.

Definitions of the terms feasible and reasonable are given in Section 1.4 of the Guideline.

Section 4.1.2 of the guideline sets out internal noise management levels for the nearby affected classrooms. It states that *'internal noise levels are to be assessed at the centre of the occupied room'*, however, *'where internal noise levels cannot be measured, external noise levels may be used. A conservative estimate of the difference between internal and external noise levels is 10 dB* (through an open window) *for buildings other than residences'*.

Note: it is assumed the windows on the project, *'RE'* will be of standard construction. Standard construction will reduce noise levels by 20 dB from outside to inside. Therefore, an external criteria of 65 dBA at *'RE'* will also meet the Guideline's requirements for an internal noise level of (65 – 20 =) 45 dBA.

The noise management levels for the nearby place of worship and hospital wards are as follows:

- 'RE' Classrooms: external $L_{Aeq, 15 minute}$ (45 + 20 =) 65 dBA.

The Project Manager or Site Manager should consult with the College when the occupants are likely to be affected by noise from the works to schedule the projects work hours to achieve a reasonable noise outcome.

Section 4.1.3 of the guideline sets out noise management levels at the nearby affected industrial premises. It states that 'the external noise levels should be assessed at the most-affected occupied point of the premises', as follows:

- industrial premises: external $L_{Aeq, 15 minute}$ 75 dBA.

During construction, the proponent should regularly update the occupant of the industrial premises regarding noise levels and hours of work.

5.4.2 EPA Vibration Guideline

The NSW EPA published the *Assessing Vibration: a technical guideline* in February 2006. This guideline is based on the British Standard BS6472:1992 *"Evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz)."*

The guideline presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. The guideline considers vibration from construction activities as Intermittent Vibration. Table 2.4 of the guideline sets out limits for Vibration Dose Values to assess intermittent vibration and is replicated below in Table 6 for residential, educational and industrial receptor locations.

Table 6 Vibration Dose Values (VDV) from Construction Activities

Receptor Location	Daytime	
	Preferred value ($m/s^{1.75}$)	Maximum value ($m/s^{1.75}$)
All Residences	0.20	0.40
Offices, schools, educational institutions	0.40	0.80
Workshops	0.80	1.60

The British Standard BS7385-2:1993 *"Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration"* provides guide values for transient vibration relating to cosmetic damage, replicated below in Table 7 for residential and industrial buildings.

Table 7 Transient Vibration Guide Values for Cosmetic Damage

Type of building	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Residential buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
Educational buildings/ Industrial buildings	50 mm/s at 4 Hz and above	

In our opinion, an overall peak particle velocity of **15 mm/s** at the boundaries of residential receptors and **50 mm/s** at the boundaries of educational and industrial receptors will comply with the recommended values in Table 7, and is an acceptable criterion for intermittent vibration to prevent cosmetic damage to the adjacent residential, educational and industrial buildings.

5.5 Project Noise Trigger Levels

In our opinion, the most relevant noise and vibration management levels for this development are those outlined in Sections 5.4.1 and 5.4.2 of this report, and summarised as follows:

5.5.1 Noise Management Levels

- Noise management level of **46 dBA** $L_{Aeq,\ 15\ minute}$ for all residential receptors;
- Noise management level of **65 dBA** $L_{Aeq,\ 15\ minute}$ for all educational receptors; and
- Noise management level of **75 dBA** $L_{eq,\ 15\ minute}$ for all industrial receptors.

5.5.2 Vibration Management Levels

- A Vibration Dose Value (VDV) between **0.2 – 0.4 m/s$^{1.75}$** for human annoyance in residential buildings;
- A Vibration Dose Value (VDV) between **0.4 – 0.8 m/s$^{1.75}$** for human annoyance in residential buildings;
- A Vibration Dose Value (VDV) between **0.8 – 1.6 m/s$^{1.75}$** for human annoyance in industrial buildings;
- A Peak Particle Velocity no greater than **15 mm/s** for cosmetic damage at the residential buildings; and
- A Peak Particle Velocity no greater than **50 mm/s** for cosmetic damage at the educational and industrial buildings.

6.0 STAGE 1 TO STAGE 4 - NOISE EMISSION

The main sources of noise on the site during the three phases of demolition, excavation and construction will be from heavy machinery such as excavators, dump trucks, cranes, cement mixers, rock breakers, etc.

Unless otherwise noted, the predicted noise levels in the following Sections assume that all equipment and plant listed are operating at the same time within the same general area along the nearest or furthest boundaries. This constitutes a worst-case scenario, however, due to the nature of the works, it is more likely that equipment will be dispersed over a wider area of the construction site and will not be continuously operating simultaneously. Typically, therefore, lower average levels can be expected.

A schedule of the sound power levels for the main demolition, excavation and construction equipment was extracted from the Day Design database of Sound Power Levels and the Australian Standard AS2436:1981 *"Guide to Noise Control on Construction, Maintenance and Demolition Sites".*

Knowing the sound power level of a noise source, the sound pressure level (as measured with a sound level meter) can be calculated at a remote location using suitable formulae to account for distance losses, barrier effects, etc.

Calculations consider distance attenuation and attenuation provided by intervening structures (i.e. future educational buildings) only and the range of levels are based on the closest potential distance and furthest potential distance at which each item of plant may operate from each respective residential, educational, or industrial location. The calculated noise levels at nearby residential, educational, or industrial receptors for each are presented in the following Tables:

- Stage 1 – Tables 9, 11, 13, 14 and 15;
- Stage 2 – Tables 17, 19, 20 and 21;
- Stage 3 – Tables 23, 25, 26 and 27; and
- Stage 4 – Tables 29, 31, 32 and 33.

6.1 Stage 1 – Noise Emissions

6.1.1 Stage 1 - Phase 1 – Demolition Works

The demolition of the existing buildings is estimated to take 2 weeks and will involve the use of excavators, rock hammers to break concrete, hand tools and regular truck movements transporting waste materials from the site. The equipment likely to be used and their corresponding sound power levels are presented below in Table 8.

Table 8 Stage 1 - Typical Demolition Plant and Equipment - Sound Power Levels

Description	Sound Power Level, dBA
Excavator – Hitachi 330	107
Truck	107
Compressor	101
Generator	99
Hydraulic Rock Breaker	118
Hand Tools	102
Bobcat	106

Given the intensity of work involved with concrete breaking, it is unlikely that this activity will take place at the same time as any other activity. Therefore we have assessed the noise impact of the concrete breaking individually. The calculated noise levels at nearby receptors are presented below in Table 9 as a worst case scenario.

Table 9 Stage 1 - Calculated Receptor Sound Pressure Levels from Demolition Works

Receptor Location	Calculated Sound Pressure Levels (dBA)
R1 – 286 Catherine Fields Rd	58 – 81
R2 – 227-235 Deepfields Rd	50 – 57
R3 – 225 Deepfields Rd	51 – 59
R4 – 16 Heatherfield Cl	55 – 81
R5 – 14 Heatherfield Cl	56 – 81
R6 – 12 Heatherfield Cl	58 – 81
R7 – 260 Catherine Fields Rd	56 – 81
R8 – 265 Catherine Fields Rd	54 – 74
R9 – 271 Catherine Fields Rd	54 – 75
R10 – 277 Catherine Fields Rd	54 – 75
R11 – 285 Catherine Fields Rd	53 – 71

Table 9 Stage 1 - Calculated Receptor Sound Pressure Levels from Demolition Works - Continued

Receptor Location	Calculated Sound Pressure Levels (dBA)
Concrete Breaking	
R1 – 286 Catherine Fields Rd	63 – 86
R2 – 227-235 Deepfields Rd	56 – 63
R3 – 225 Deepfields Rd	56 – 65
R4 – 16 Heatherfield Cl	61 – 86
R5 – 14 Heatherfield Cl	62 – 86
R6 – 12 Heatherfield Cl	63 – 86
R7 – 260 Catherine Fields Rd	62 – 86
R8 – 265 Catherine Fields Rd	59 – 79
R9 – 271 Catherine Fields Rd	59 – 80
R10 – 277 Catherine Fields Rd	59 – 80
R11 – 285 Catherine Fields Rd	59 – 77

6.1.2 Stage 1 - Phase 2 – Excavation and Bulk Earth Works

The excavation and bulk earth works is estimated to take 4 weeks and will involve the use of excavators, rock hammers/saws, pile bores and regular truck movements transporting waste materials from the site. The equipment likely to be used and their corresponding sound power levels are presented below in Table 10.

Table 10 Stage 1 - Typical Excavation Works Equipment - Sound Power Levels

Description	Sound Power Level, dBA
Excavator – Hitachi 330	107
Truck	107
Compressor	101
Generator	99
Piling (Bored)	111
Hydraulic Rock Breaker	118

Note: (All sound power levels are based on previous noise measurements at various sites)

Given the intensity of work involved with rock breaking, it is unlikely that this activity will take place at the same time as any other activity. Therefore we have assessed the noise impact of rock breaking individually. The calculated noise levels at nearby receptors are presented below in Table 11 as a worst case scenario.

Table 11 Stage 1 - Calculated Receptor Sound Pressure Levels from Excavation Works

Receptor Location	Calculated Sound Pressure Levels (dBA)
R1 – 286 Catherine Fields Rd	56 – 79
R2 – 227-235 Deepfields Rd	49 – 56
R3 – 225 Deepfields Rd	49 – 57
R4 – 16 Heatherfield Cl	54 – 79
R5 – 14 Heatherfield Cl	55 – 79
R6 – 12 Heatherfield Cl	56 – 79
R7 – 260 Catherine Fields Rd	55 – 79
R8 – 265 Catherine Fields Rd	52 – 72
R9 – 271 Catherine Fields Rd	52 – 73
R10 – 277 Catherine Fields Rd	52 – 73
R11 – 285 Catherine Fields Rd	52 – 70

Table 11 Stage 1 - Calculated Receptor Sound Pressure Levels from Excavation Works - Continued

Receptor Location	Calculated Sound Pressure Levels (dBA)
Rock Breaking	
R1 – 286 Catherine Fields Rd	63 – 86
R2 – 227-235 Deepfields Rd	56 – 63
R3 – 225 Deepfields Rd	56 – 65
R4 – 16 Heatherfield Cl	61 – 86
R5 – 14 Heatherfield Cl	62 – 86
R6 – 12 Heatherfield Cl	63 – 86
R7 – 260 Catherine Fields Rd	62 – 86
R8 – 265 Catherine Fields Rd	59 – 79
R9 – 271 Catherine Fields Rd	59 – 80
R10 – 277 Catherine Fields Rd	59 – 80
R11 – 285 Catherine Fields Rd	59 – 77

6.1.3 Stage 1 - Phase 3 – Construction

The construction of the Stage 1 College buildings is estimated to take a total of 52 weeks (see Section 4.2 for more detail) and will involve the use of heavy vehicles, power tools and portable mechanical plant such as generators and compressors. The equipment likely to be used and their corresponding sound power levels are presented below in Table 12.

Table 12 Stage 1 - Typical Construction Equipment - Sound Power Levels

Description	Sound Power Level, dBA
Cement Truck	109
Crane	104
Generator	99
Compressor	101
Hand Tools	102
Bobcat	106

Note: (All sound power levels are based on previous noise measurements at various sites)

During the construction phase, work will be more dispersed across the site as the scale of work, compared to the previous phase, is less intensive. The calculated noise levels at nearby receptors are presented below in Table 13 as a worst case scenario.

Table 13 Stage 1 - Calculated Receptor Sound Pressure Levels from Construction Works

Receptor Location	Calculated Sound Pressure Levels (dBA)
R1 – 286 Catherine Fields Rd	59 – 68
R2 – 227-235 Deepfields Rd	51 – 52
R3 – 225 Deepfields Rd	51 – 52
R4 – 16 Heatherfield Cl	56 – 60
R5 – 14 Heatherfield Cl	57 – 63
R6 – 12 Heatherfield Cl	59 – 68
R7 – 260 Catherine Fields Rd	60 – 82
R8 – 265 Catherine Fields Rd	60 – 73
R9 – 271 Catherine Fields Rd	61 – 74
R10 – 277 Catherine Fields Rd	63 – 74
R11 – 285 Catherine Fields Rd	60 – 73

6.1.4 Stage 1 - Noise Emission Summary

From the calculated noise levels in Sections 6.1.1 to 6.1.3, the level of noise exceedance are presented below in Tables 14 and 15.

Table 14 Stage 1 - Calculated $L_{eq\ 15\ minute}$ Noise Levels (Without Noise Controls) – R1 to R6

Description	Calculated Noise Levels (dBA)					
	R1	R2	R3	R4	R5	R6
Phase 1 – Demolition Works						
Demolition Works	58 – 81	50 – 57	51 – 59	55 – 81	56 – 81	58 – 81
Rock Hammering	63 – 86	56 – 63	56 – 65	61 – 86	62 – 86	63 – 86
Noise Management Level	46	46	75	46	46	46
Exceedance	**Up to 40 dB**	**Up to 17 dB**	**No**	**Up to 40 dB**	**Up to 40 dB**	**Up to 40 dB**
Phase 2 – Excavation Works						
Excavation Works	56 – 79	49 – 56	49 – 57	54 – 79	55 – 79	56 – 79
Rock Hammering	63 – 86	56 – 63	56 – 65	61 – 86	62 – 86	63 – 86
Noise Management Level	46	46	75	46	46	46
Exceedance	**Up to 40 dB**	**Up to 17 dB**	**No**	**Up to 40 dB**	**Up to 40 dB**	**Up to 40 dB**
Phase 3 – Construction						
Construction Works	59 – 68	51 – 52	51 – 52	56 – 60	57 – 63	59 – 68
Noise Management Level	46	46	75	46	46	46
Exceedance	**Up to 22 dB**	**Up to 6 dB**	**No**	**Up to 14 dB**	**Up to 17 dB**	**Up to 22 dB**

Table 15 Stage 1 - Calculated $L_{eq\ 15\ minute}$ Noise Levels (Without Noise Controls) – R7 to R11

Description	Calculated Noise Levels (dBA)				
	R7	R8	R9	R10	R11
Phase 1 – Demolition Works					
Demolition Works	56 – 81	54 – 74	54 – 75	54 – 75	53 – 71
Rock Hammering	62 – 86	59 – 79	59 – 80	59 – 80	59 – 77
Noise Management Level	46	46	46	46	46
Exceedance	**Up to 40 dB**	**Up to 33 dB**	**Up to 34 dB**	**Up to 34 dB**	**Up to 31 dB**
Phase 2 – Excavation Works					
Excavation Works	55 – 79	52 – 72	52 – 73	52 – 73	52 – 70
Rock Hammering	62 – 86	59 – 79	59 – 80	59 – 80	59 – 77
Noise Management Level	46	46	46	46	46
Exceedance	**Up to 40 dB**	**Up to 33 dB**	**Up to 34 dB**	**Up to 34 dB**	**Up to 31 dB**
Phase 3 – Construction					
Construction Works	60 – 82	60 – 73	61 – 74	63 – 74	60 – 73
Noise Management Level	46	46	46	46	46
Exceedance	**Up to 36 dB**	**Up to 27 dB**	**Up to 28 dB**	**Up to 28 dB**	**Up to 27 dB**

It can be seen from Tables 14 and 15 above, that the predicted levels of noise from construction activities will at times be in excess of the noise management levels of 46 dBA at residential receptor locations. There is also potential for the highly noise affected level of 75 dBA to be exceeded at 'R1' and 'R4' to 'R11' during the construction phases.

To minimise the noise impact from the construction activities we recommend that the noise controls and the management plan detailed in Section 7 of this report be implemented.

Rock hammering is not considered cumulatively as it is unknown at this stage whether it will be required, and if so where it may be required. To include it in the cumulative noise predictions would potentially over-state the predicted impact. However, as a precaution, it is recommended in the noise management controls (Section 7.2) that in the event that rock hammering is required near to residential receptors, it is conducted in the absence of any other plant operations to avoid a cumulative noise impact.

6.2 Stage 2 – Noise Emissions

6.2.1 Stage 2 – Phase 2 – Excavation and Bulk Earth Works

The excavation and bulk earth works is estimated to take 4 weeks and will involve the use of excavators, rock hammers/saws, pile bores and regular truck movements transporting waste materials from the site. The equipment likely to be used and their corresponding sound power levels are presented below in Table 16.

Table 16 Stage 2 - Typical Excavation Works Equipment - Sound Power Levels

Description	Sound Power Level, dBA
Excavator – Hitachi 330	107
Truck	107
Compressor	101
Generator	99
Piling (Bored)	111
Hydraulic Rock Breaker	118

Note: (All sound power levels are based on previous noise measurements at various sites)

Given the intensity of work involved with rock breaking, it is unlikely that this activity will take place at the same time as any other activity. Therefore we have assessed the noise impact of rock breaking individually. The calculated noise levels at nearby receptors are presented below in Table 17 as a worst case scenario.

Table 17 Stage 2 - Calculated Receptor Sound Pressure Levels from Excavation Works

Receptor Location	Calculated Sound Pressure Levels (dBA)
R1 – 286 Catherine Fields Rd	57 – 61
R2 – 227-235 Deepfields Rd	48 – 52
R3 – 225 Deepfields Rd	49 – 53
R4 – 16 Heatherfield Cl	54 – 68
R5 – 14 Heatherfield Cl	55 – 75
R6 – 12 Heatherfield Cl	57 – 79
R7 – 260 Catherine Fields Rd	57 – 79
R8 – 265 Catherine Fields Rd	56 – 71
R9 – 271 Catherine Fields Rd	45 – 72
R10 – 277 Catherine Fields Rd	45 – 72
R11 – 285 Catherine Fields Rd	44 – 71
RE – Minarah College Educational Buildings	59 – 79

Table 17 Stage 2 - Calculated Receptor Sound Pressure Levels from Excavation Works - Continued

Receptor Location	Calculated Sound Pressure Levels (dBA)
Rock Breaking	
R1 – 286 Catherine Fields Rd	64 – 68
R2 – 227-235 Deepfields Rd	55 – 59
R3 – 225 Deepfields Rd	56 – 61
R4 – 16 Heatherfield Cl	61 – 75
R5 – 14 Heatherfield Cl	63 – 82
R6 – 12 Heatherfield Cl	64 – 86
R7 – 260 Catherine Fields Rd	65 – 86
R8 – 265 Catherine Fields Rd	63 – 78
R9 – 271 Catherine Fields Rd	53 – 79
R10 – 277 Catherine Fields Rd	52 – 79
R11 – 285 Catherine Fields Rd	51 – 78
RE – Minarah College Educational Buildings	66 – 86

6.2.2 Stage 2 – Phase 3 – Construction

The construction of the Stage 2 College buildings is estimated to take a total of 40 weeks (see Section 4.2 for more detail) and will involve the use of heavy vehicles, power tools and portable mechanical plant such as generators and compressors. The equipment likely to be used and their corresponding sound power levels are presented below in Table 18.

Table 18 Stage 2 - Typical Construction Equipment - Sound Power Levels

Description	Sound Power Level, dBA
Cement Truck	109
Crane	104
Generator	99
Compressor	101
Hand Tools	102
Bobcat	106

Note: (All sound power levels are based on previous noise measurements at various sites)

During the construction phase, work will be more dispersed across the site as the scale of work, compared to the previous phase, is less intensive. The calculated noise levels at nearby receptors are presented below in Table 19 as a worst case scenario.

Table 19 Stage 2 - Calculated Receptor Sound Pressure Levels from Construction Works

Receptor Location	Calculated Sound Pressure Levels (dBA)
R1 – 286 Catherine Fields Rd	59 – 63
R2 – 227-235 Deepfields Rd	51 – 54
R3 – 225 Deepfields Rd	51 – 56
R4 – 16 Heatherfield Cl	56 – 70
R5 – 14 Heatherfield Cl	58 – 77
R6 – 12 Heatherfield Cl	60 – 82
R7 – 260 Catherine Fields Rd	61 – 82
R8 – 265 Catherine Fields Rd	58 – 73
R9 – 271 Catherine Fields Rd	48 – 74
R10 – 277 Catherine Fields Rd	47 – 74
R11 – 285 Catherine Fields Rd	47 – 73
RE – Minarah College Educational Buildings	61 – 82

6.2.3 Stage 2 – Noise Emission Summary

From the calculated noise levels in Sections 6.2.1 to 6.2.2, the level of noise exceedance are presented below in Tables 20 and 21.

Table 20 Stage 2 - Calculated $L_{eq\ 15\ minute}$ Noise Levels (Without Noise Controls) – R1 to R6

Description	Calculated Noise Levels (dBA)					
	R1	R2	R3	R4	R5	R6
Phase 2 – Excavation Works						
Excavation Works	57 – 61	48 – 52	49 – 53	54 – 68	55 – 75	57 – 79
Rock Hammering	64 – 68	55 – 59	56 – 61	61 – 75	63 – 82	64 – 86
Noise Management Level	46	46	75	46	46	46
Exceedance	**Up to 22 dB**	**Up to 13 dB**	**No**	**Up to 29 dB**	**Up to 36 dB**	**Up to 40 dB**
Phase 3 – Construction						
Construction Works	59 – 63	51 – 54	51 – 56	56 – 70	58 – 77	60 – 82
Noise Management Level	46	46	75	46	46	46
Exceedance	**Up to 17 dB**	**Up to 8 dB**	**No**	**Up to 24 dB**	**Up to 31 dB**	**Up to 36 dB**

Table 21 Stage 2 – Calculated $L_{eq\ 15\ minute}$ Noise Levels (Without Noise Controls) – R7 to RE

Description	Calculated Noise Levels (dBA)					
	R7	**R8**	**R9**	**R10**	**R11**	**RE**
Phase 2 – Excavation Works						
Excavation Works	58 – 79	56 – 71	45 – 72	45 – 72	44 – 71	59 – 79
Rock Hammering	65 – 86	63 – 78	53 – 79	52 – 79	51 – 78	66 – 86
Noise Management Level	46	46	46	46	46	65
Exceedance	**Up to 40 dB**	**Up to 32 dB**	**Up to 33 dB**	**Up to 33 dB**	**Up to 32 dB**	**Up to 21 dB**
Phase 3 – Construction						
Construction Works	61 – 82	58 – 73	48 – 74	47 – 74	47 – 73	61 – 82
Noise Management Level	46	46	46	46	46	65
Exceedance	**Up to 36 dB**	**Up to 27 dB**	**Up to 28 dB**	**Up to 28 dB**	**Up to 27 dB**	**Up to 17 dB**

It can be seen from Tables 20 and 21 above, that the predicted levels of noise from construction activities will at times be in excess of the noise management levels of 46 dBA at residential receptor locations and 65 dBA at educational receptor locations. There is also potential for the highly noise affected level of 75 dBA to be exceeded at 'R4' to 'R11' during the construction phases.

To minimise the noise impact from the construction activities we recommend that the noise controls and the management plan detailed in Section 7 of this report be implemented.

Rock hammering is not considered cumulatively as it is unknown at this stage whether it will be required, and if so where it may be required. To include it in the cumulative noise predictions would potentially over-state the predicted impact. However, as a precaution, it is recommended in the noise management controls (Section 7.2) that in the event that rock hammering is required near to residential or educational receptors, it is conducted in the absence of any other plant operations to avoid a cumulative noise impact.

6.3 Stage 3 – Noise Emissions

6.3.1 Stage 3 – Phase 2 – Excavation and Bulk Earth Works

The excavation and bulk earth works is estimated to take 4 weeks and will involve the use of excavators, rock hammers/saws, pile bores and regular truck movements transporting waste materials from the site. The equipment likely to be used and their corresponding sound power levels are presented below in Table 22.

Table 22 Stage 3 - Typical Excavation Works Equipment - Sound Power Levels

Description	Sound Power Level, dBA
Excavator – Hitachi 330	107
Truck	107
Compressor	101
Generator	99
Piling (Bored)	111
Hydraulic Rock Breaker	118

Note: (All sound power levels are based on previous noise measurements at various sites)

Given the intensity of work involved with rock breaking, it is unlikely that this activity will take place at the same time as any other activity. Therefore we have assessed the noise impact of rock breaking individually. The calculated noise levels at nearby receptors are presented below in Table 23 as a worst case scenario.

Table 23 Stage 3 - Calculated Receptor Sound Pressure Levels from Excavation Works

Receptor Location	Calculated Sound Pressure Levels (dBA)
R1 – 286 Catherine Fields Rd	56 – 77
R2 – 227-235 Deepfields Rd	49 – 55
R3 – 225 Deepfields Rd	50 – 57
R4 – 16 Heatherfield Cl	45 – 77
R5 – 14 Heatherfield Cl	47 – 77
R6 – 12 Heatherfield Cl	46 – 77
R7 – 260 Catherine Fields Rd	43 – 64
R8 – 265 Catherine Fields Rd	42 – 62
R9 – 271 Catherine Fields Rd	42 – 64
R10 – 277 Catherine Fields Rd	42 – 59
R11 – 285 Catherine Fields Rd	41 – 63
RE – Minarah College Educational Buildings	59 – 83

Table 23 Stage 3 - Calculated Receptor Sound Pressure Levels from Excavation Works - Continued

Receptor Location	Calculated Sound Pressure Levels (dBA)
Rock Breaking	
R1 – 286 Catherine Fields Rd	63 – 84
R2 – 227-235 Deepfields Rd	56 – 63
R3 – 225 Deepfields Rd	57 – 64
R4 – 16 Heatherfield Cl	52 – 84
R5 – 14 Heatherfield Cl	54 – 84
R6 – 12 Heatherfield Cl	53 – 84
R7 – 260 Catherine Fields Rd	50 – 71
R8 – 265 Catherine Fields Rd	49 – 70
R9 – 271 Catherine Fields Rd	49 – 71
R10 – 277 Catherine Fields Rd	49 – 66
R11 – 285 Catherine Fields Rd	49 – 70
RE – Minarah College Educational Buildings	66 – 90

6.3.2 Stage 3 – Phase 3 – Construction

The construction of the Stage 3 College buildings is estimated to take a total of 40 weeks (see Section 4.2 for more detail) and will involve the use of heavy vehicles, power tools and portable mechanical plant such as generators and compressors. The equipment likely to be used and their corresponding sound power levels are presented below in Table 24.

Table 24 Stage 3 - Typical Construction Equipment - Sound Power Levels

Description	Sound Power Level, dBA
Cement Truck	109
Crane	104
Generator	99
Compressor	101
Hand Tools	102
Bobcat	106

Note: (All sound power levels are based on previous noise measurements at various sites)

During the construction phase, work will be more dispersed across the site as the scale of work, compared to the previous phase, is less intensive. The calculated noise levels at nearby receptors are presented below in Table 25 as a worst case scenario.

Table 25 Stage 3 - Calculated Receptor Sound Pressure Levels from Construction Works

Receptor Location	Calculated Sound Pressure Levels (dBA)
R1 – 286 Catherine Fields Rd	57 – 79
R2 – 227-235 Deepfields Rd	52 – 58
R3 – 225 Deepfields Rd	52 – 59
R4 – 16 Heatherfield Cl	48 – 79
R5 – 14 Heatherfield Cl	49 – 79
R6 – 12 Heatherfield Cl	48 – 79
R7 – 260 Catherine Fields Rd	46 – 67
R8 – 265 Catherine Fields Rd	45 – 65
R9 – 271 Catherine Fields Rd	44 – 66
R10 – 277 Catherine Fields Rd	44 – 61
R11 – 285 Catherine Fields Rd	44 – 66
RE – Minarah College Educational Buildings	62 – 85

6.3.3 Stage 3 – Noise Emission Summary

From the calculated noise levels in Sections 6.3.1 to 6.3.2, the level of noise exceedance are presented below in Tables 26 and 27.

Table 26 Stage 3 - Calculated $L_{eq\ 15\ minute}$ Noise Levels (Without Noise Controls) – R1 to R6

Description	**Calculated Noise Levels (dBA)**					
	R1	**R2**	**R3**	**R4**	**R5**	**R6**
Phase 2 – Excavation Works						
Excavation Works	56 – 77	49 – 55	50 – 57	45 – 77	47 – 77	46 – 77
Rock Hammering	63 – 84	56 – 63	57 – 64	52 – 84	54 – 84	53 – 84
Noise Management Level	46	46	75	46	46	46
Exceedance	**Up to 38 dB**	**Up to 17 dB**	**No**	**Up to 38 dB**	**Up to 38 dB**	**Up to 38 dB**
Phase 3 – Construction						
Construction Works	58 – 79	52 – 58	52 – 59	48 – 79	49 – 79	48 – 79
Noise Management Level	46	46	75	46	46	46
Exceedance	**Up to 33 dB**	**Up to 12 dB**	**No**	**Up to 33 dB**	**Up to 33 dB**	**Up to 33 dB**

Table 27 Stage 3 - Calculated $L_{eq\ 15\ minute}$ Noise Levels (Without Noise Controls) – R7 to RE

Description	Calculated Noise Levels (dBA)					
	R7	**R8**	**R9**	**R10**	**R11**	**RE**
Phase 2 – Excavation Works						
Excavation Works	43 – 64	42 – 62	42 – 64	42 – 59	41 – 63	59 – 83
Rock Hammering	50 – 71	49 – 70	49 – 71	49 – 66	49 – 70	66 – 90
Noise Management Level	46	46	46	46	46	65
Exceedance	**Up to 25 dB**	**Up to 24 dB**	**Up to 25 dB**	**Up to 20 dB**	**Up to 24 dB**	**Up to 25 dB**
Phase 3 – Construction						
Construction Works	46 – 67	45 – 65	44 – 66	44 – 61	44 – 66	62 – 85
Noise Management Level	46	46	46	46	46	65
Exceedance	**Up to 21 dB**	**Up to 19 dB**	**Up to 20 dB**	**Up to 15 dB**	**Up to 20 dB**	**Up to 20 dB**

It can be seen from Tables 26 and 27 above, that the predicted levels of noise from construction activities will at times be in excess of the noise management levels of 46 dBA at residential receptor locations and 65 dBA at educational receptor locations. There is also potential for the highly noise affected level of 75 dBA to be exceeded at ‘R1’ and ‘R4’ to ‘R6’ during the construction phases.

To minimise the noise impact from the construction activities we recommend that the noise controls and the management plan detailed in Section 7 of this report be implemented.

Rock hammering is not considered cumulatively as it is unknown at this stage whether it will be required, and if so where it may be required. To include it in the cumulative noise predictions would potentially over-state the predicted impact. However, as a precaution, it is recommended in the noise management controls (Section 7.2) that in the event that rock hammering is required near to residential receptors, it is conducted in the absence of any other plant operations to avoid a cumulative noise impact.

6.4 Stage 4 – Noise Emissions

6.4.1 Stage 4 – Phase 2 – Excavation and Bulk Earth Works

The excavation and bulk earth works is estimated to take 4 weeks and will involve the use of excavators, rock hammers/saws, pile bores and regular truck movements transporting waste materials from the site. The equipment likely to be used and their corresponding sound power levels are presented below in Table 28.

Table 28 Stage 4 - Typical Excavation Works Equipment - Sound Power Levels

Description	Sound Power Level, dBA
Excavator – Hitachi 330	107
Truck	107
Compressor	101
Generator	99
Piling (Bored)	111
Hydraulic Rock Breaker	118

Note: (All sound power levels are based on previous noise measurements at various sites)

Given the intensity of work involved with rock breaking, it is unlikely that this activity will take place at the same time as any other activity. Therefore we have assessed the noise impact of rock breaking individually. The calculated noise levels at nearby receptors are presented below in Table 29 as a worst case scenario.

Table 29 Stage 4 - Calculated Receptor Sound Pressure Levels from Excavation Works

Receptor Location	Calculated Sound Pressure Levels (dBA)
R1 – 286 Catherine Fields Rd	62 – 72
R2 – 227-235 Deepfields Rd	51 – 52
R3 – 225 Deepfields Rd	52 – 53
R4 – 16 Heatherfield Cl	48 – 63
R5 – 14 Heatherfield Cl	55 – 65
R6 – 12 Heatherfield Cl	48 – 54
R7 – 260 Catherine Fields Rd	46 – 49
R8 – 265 Catherine Fields Rd	45 – 47
R9 – 271 Catherine Fields Rd	45 – 47
R10 – 277 Catherine Fields Rd	45 – 47
R11 – 285 Catherine Fields Rd	50 – 58
RE – Minarah College Educational Buildings	67 – 83

Table 29 Stage 4 - Calculated Receptor Sound Pressure Levels from Excavation Works - Continued

Receptor Location	Calculated Sound Pressure Levels (dBA)
Rock Breaking	
R1 – 286 Catherine Fields Rd	70 – 79
R2 – 227-235 Deepfields Rd	58 – 59
R3 – 225 Deepfields Rd	59 – 60
R4 – 16 Heatherfield Cl	55 – 70
R5 – 14 Heatherfield Cl	62 – 72
R6 – 12 Heatherfield Cl	56 – 61
R7 – 260 Catherine Fields Rd	53 – 56
R8 – 265 Catherine Fields Rd	52 – 54
R9 – 271 Catherine Fields Rd	52 – 54
R10 – 277 Catherine Fields Rd	53 – 54
R11 – 285 Catherine Fields Rd	57 – 65
RE – Minarah College Educational Buildings	74 – 90

6.4.2 Stage 4 - Phase 3 – Construction

The construction of the Stage 4 College buildings is estimated to take a total of 40 weeks (see Section 4.2 for more detail) and will involve the use of heavy vehicles, power tools and portable mechanical plant such as generators and compressors. The equipment likely to be used and their corresponding sound power levels are presented below in Table 30.

Table 30 Stage 4 - Typical Construction Equipment - Sound Power Levels

Description	Sound Power Level, dBA
Cement Truck	109
Crane	104
Generator	99
Compressor	101
Hand Tools	102
Bobcat	106

Note: (All sound power levels are based on previous noise measurements at various sites)

During the construction phase, work will be more dispersed across the site as the scale of work, compared to the previous phase, is less intensive. The calculated noise levels at nearby receptors are presented below in Table 31 as a worst case scenario.

Table 31 Stage 4 - Calculated Receptor Sound Pressure Levels from Construction Works

Receptor Location	Calculated Sound Pressure Levels (dBA)
R1 – 286 Catherine Fields Rd	65 – 74
R2 – 227-235 Deepfields Rd	54 – 55
R3 – 225 Deepfields Rd	54 – 56
R4 – 16 Heatherfield Cl	51 – 65
R5 – 14 Heatherfield Cl	57 – 67
R6 – 12 Heatherfield Cl	51 – 56
R7 – 260 Catherine Fields Rd	48 – 52
R8 – 265 Catherine Fields Rd	47 – 49
R9 – 271 Catherine Fields Rd	48 – 49
R10 – 277 Catherine Fields Rd	48 – 50
R11 – 285 Catherine Fields Rd	53 – 60
RE – Minarah College Educational Buildings	70 – 85

6.4.3 Stage 4 - Noise Emission Summary

From the calculated noise levels in Sections 6.4.1 to 6.4.2, the level of noise exceedance are presented below in Tables 32 and 33.

Table 32 Stage 4 - Calculated $L_{eq\ 15\ minute}$ Noise Levels (Without Noise Controls) – R1 to R6

Description	**Calculated Noise Levels (dBA)**					
	R1	**R2**	**R3**	**R4**	**R5**	**R6**
Phase 2 – Excavation Works						
Excavation Works	62 – 72	51 – 52	52 – 53	48 – 63	55 – 65	48 – 54
Rock Hammering	70 – 79	58 – 59	59 – 60	55 – 70	62 – 72	56 – 61
Noise Management Level	46	46	75	46	46	46
Exceedance	**Up to 33 dB**	**Up to 13 dB**	**No**	**Up to 24 dB**	**Up to 26 dB**	**Up to 15 dB**
Phase 3 – Construction						
Construction Works	65 – 74	54 – 55	54 – 56	51 – 65	57 – 67	61 – 56
Noise Management Level	46	46	75	46	46	46
Exceedance	**Up to 28 dB**	**Up to 9 dB**	**No**	**Up to 19 dB**	**Up to 21 dB**	**Up to 10 dB**

Table 33 Stage 4 - Calculated $L_{eq\ 15\ minute}$ Noise Levels (Without Noise Controls) – R7 to RE

Description	Calculated Noise Levels (dBA)					
	R7	R8	R9	R10	R11	RE
Phase 2 – Excavation Works						
Excavation Works	46 – 49	45 – 47	45 – 47	45 – 47	50 – 58	67 – 83
Rock Hammering	53 – 46	52 – 54	52 – 54	53 – 54	57 – 65	74 – 90
Noise Management Level	46	46	46	46	46	65
Exceedance	**Up to 10 dB**	**Up to 8 dB**	**Up to 8 dB**	**Up to 8 dB**	**Up to 19 dB**	**Up to 25 dB**
Phase 3 – Construction						
Construction Works	48 – 52	47 – 49	48 – 49	48 – 50	53 – 60	70 – 85
Noise Management Level	46	46	46	46	46	65
Exceedance	**Up to 6 dB**	**Up to 3 dB**	**Up to 3 dB**	**Up to 4 dB**	**Up to 14 dB**	**Up to 20 dB**

It can be seen from Tables 32 and 33 above, that the predicted levels of noise from construction activities will at times be in excess of the noise management levels of 46 dBA at residential receptor locations and 65 dBA at educational receptor locations. There is also potential for the highly noise affected level of 75 dBA to be exceeded at 'R1' during the construction phases.

To minimise the noise impact from the construction activities we recommend that the noise controls and the management plan detailed in Section 7 of this report be implemented.

Rock hammering is not considered cumulatively as it is unknown at this stage whether it will be required, and if so where it may be required. To include it in the cumulative noise predictions would potentially over-state the predicted impact. However, as a precaution, it is recommended in the noise management controls (Section 7.2) that in the event that rock hammering is required near to residential receptors, it is conducted in the absence of any other plant operations to avoid a cumulative noise impact.

6.5 Stage 1 to 4 - Vibration Emission

It is difficult to accurately predict levels of ground borne vibration at remote locations as there are many variables to consider including the surrounding terrain, strata, rock density, etc.

Previous measurements of ground borne vibration from rock hammering show that vibration levels can vary significantly at different distances and receptor locations. Given the distances from neighbouring developments to any potential rock hammering on site, if warranted (a substantiated complaint is received regarding vibration levels, cosmetic damage to a structure, etc), we recommend that compliance monitoring of ground borne vibration is carried out at the critical receptor, wherever these activities are required.

Recommendations are made in Section 7.4 of this report should complaints arise from nearby premises regarding vibration from the site.

7.0 NOISE CONTROL RECOMMENDATIONS

The predicted level of noise emission from the demolition, excavation and construction activities at the proposed Minarah College, 268-278 Catherine Fields Road, Catherine Field, NSW is in excess of the noise management levels established in Section 5.5 of this report.

In order to minimise the noise impact from all demolition, excavation and construction activities, we recommend the following engineering and management noise controls be implemented.

7.1 Engineering and Practical Noise Controls

Australian Standard AS2436:2010, Appendix C, Table C3 provides the relative effectiveness of various forms of noise control that may be applicable and implemented on various construction sites and projects. Table C3 is replicated below in Table 34.

Table 34 Relative Effectiveness of Various Forms of Noise Control

Control by	Nominal Noise Reduction Possible, dB
Distance	Approximately 6 dB for each doubling of distance
Enclosure	Normally 5 dB to 25 dB maximum 50 dB
Silencing	Normally 5 dB to 10 dB maximum 20 dB

Distance

Where applicable, we recommend locating mechanical plant near the centre of the construction area such that it is as far as practically possible from the residences to the north and south and any educational building.

Enclosure

Constructing acoustical enclosures around items of mobile plant such as generators is recommended where extended use for long periods of time is expected.

Silencing

Consideration should be given to any mobile plant already acoustically treated when assessing tenders. All plant and machinery should be selected with consideration to low noise options where practicable and available.

Care should be taken to ensure that no more than one item of plant is operating simultaneously within close proximity of any given residence as far as reasonably practicable, to minimise cumulative noise impacts.

7.2 Noise Management Controls

The following noise management controls are derived from, or are in accordance with recommendations given in Australian Standard AS2436:2010 and the EPA's *Interim Construction Noise Guideline*.

Periods of Respite

We recommend that noisy construction activities such as rock hammering or the like only operate for 2 to 3 hours at a time.

Ensure activities in any one location are staggered, for instance, if rock hammering is occurring near to a residential or educational receptor, all other construction activities will cease in the same location so as to minimise cumulative noise impacts.

Alternatively, if reasonable/feasible, noisy construction activities that may affect existing educational buildings should take place outside of normal school hours or during the school holidays.

Work Practices

We recommend that workers and contractors be trained in work practices to minimise noise emission such as the following:

- Avoid dropping materials from a height.
- Avoid shouting and talking loudly outdoors.
- Avoid the use of radios outdoors that can be heard at the boundary of residences.
- Turn off equipment when not being used.
- Carry out work only within the proposed hours of operation (see Section 4.2).

Heavy Vehicles and Staff Vehicles

- Keep truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices (for example, minimising the use of engine brakes, and no extended periods of engine idling).
- Locate site vehicle entrances away from residences where practicable.
- Optimise the number of vehicle trips to and from the site – movements can be organised to amalgamate loads rather than using a number of vehicles with smaller loads.
- Staff parking areas should be located as far from residential receiver locations as practicable.
- No motor vehicles should access the site via, or park within residential areas prior to 7 am on any occasion, in order avoid sleep disturbance.

Community Relations

- A Community Liaison Officer (Project Manager or Site Manager) is to be appointed by the contractor prior to the commencement of any works.
- The Community Liaison Officer will approach all potentially affected residents prior to the commencement of any works as an initial introduction and provide his or her contact details.
- The Community Liaison Officer will explain the project, duration of works, potentially noisy periods as well as determine any particularly sensitive receivers or sensitive time periods and schedule works accordingly, as far as reasonably practical.
- A contact number will be provided for any residents to call with complaints or queries.

Once works commence, communication with the community should be maintained by the Community Liaison Officer. Communication should be maintained via a range of media including, for example, continued individual contact, letter box drops or a clearly visible notice board at the site office or on construction site boundaries.

Consultation and cooperation between the contractor and the neighbours and the removal of uncertainty and rumour can help to reduce adverse reaction to noise.

Managing a Noise Complaint

The Community Liaison Officer should receive and manage noise complaints.

All complaints should be treated promptly and with courtesy.

Should a justified noise complaint not be resolved, noise monitoring may be carried out at the affected receptor location and appropriate measures be taken to reduce the noise emission as far as reasonably practicable.

Where it is not practicable to stop the noise, or reduce the noise, a full explanation of the event taking place, the reason for the noise and times when it will stop should be given to the complainant.

The following guidelines are recommended in Section 6 of the *Interim Construction Noise Guideline* to manage a noise complaint:

- Provide a readily accessible contact point.
- Give complaints a fair hearing.
- Have a documented complaints process, including an escalation procedure so that if a complainant is not satisfied there is a clear path to follow.
- Call back as soon as possible to keep people informed of action to be taken to address noise problems. Call back at night-time only if requested by the complainant to avoid further disturbance.
- Provide a quick response to complaints, with complaint handling staff having both a good knowledge of the project and ready access to information.

- Implement all feasible and reasonable measures to address the source of complaint.
- Keep a register of any complaints, including details of the complaint such as date, time, person receiving complaint, complainant's contact number, person referred to, description of the complaint, work area (for larger projects), time of verbal response and timeframe for written response where appropriate.

7.3 Noise Monitoring

We recommend that noise emissions from the development be measured during the construction periods in the event that complaints arise from nearby residences, regarding noise.

The noise measurements should be carried out using an attended noise monitor at the location (or as close as practically possible) of the noise complaint. Noise level measurements should be carried out by an appropriately qualified acoustical consultant/engineer, using Type 1 (see AS1259) noise measuring equipment.

The measured noise level are to be compared against the Project Noise Trigger Levels shown in Section 5.5 of this report. The outcomes of the noise monitoring should be submitted to the relevant authority for review.

7.4 Vibration Monitoring

We recommend that the level of vibration be measured during any rock hammering/concrete breaking in the event complaints arise from any nearby receivers/premises regarding vibration.

The vibration measurements can be carried out using either an attended or an unattended vibration monitor. An unattended vibration monitor should be fitted with an alarm in the form of a strobe light, siren or digital (mobile/computer) alert system to make the plant operator aware immediately when the vibration limit is exceeded. The vibration monitor should be set to trigger the alarm when the overall Peak Particle Velocity (PPV) exceeds **15 mm/s** at the nearest residential building or **50 mm/s** at the nearest educational or industrial buildings.

Dilapidation reports should be commissioned for potentially affected nearby premises prior to any works being undertaken, particularly the adjacent heritage buildings to the north and south - east. This may be reassessed once the extent of required work is known.

In the event that levels of ground-borne vibration exceed the recommended acceptable levels for cosmetic damage, vibration causing works should cease immediately and alternative methods, such as rock sawing, be considered.

7.5 Construction Disclaimer

Recommendations made in this report are intended to resolve acoustical problems only. We make no claims of expertise in other areas of building construction and therefore the recommended noise controls should be implements into the building design in consultation with other specialists to ensure they meet the structural, fire, thermal or other aspects of building construction.

We encourage clients to check with us before using materials or equipment that are alternative to those specified in our Acoustical Report.

8.0 STAGE 1 TO STAGE 4 - NOISE EMISSION AFTER NOISE CONTROLS

The main sources of noise on the site during the three phases of demolition, excavation and construction will be from heavy machinery such as excavators, dump trucks, cranes, cement mixers, rock breakers, etc. Day Design note that the engineering and practical noise controls recommended in Section 7.1 are not applicable to large machinery such as excavators, dump trucks, cranes, cement mixers, rock breakers.

Unless otherwise noted, the predicted noise levels in the following Sections assume that all equipment and plant listed are operating at the same time within the same general area along the nearest or furthest boundaries. This constitutes a worst-case scenario, however, due to the nature of the works, it is more likely that equipment will be dispersed over a wider area of the construction site and will not be continuously operating simultaneously. Typically, therefore, lower average levels can be expected.

A schedule of the sound power levels for the main demolition, excavation and construction equipment was extracted from the Day Design database of Sound Power Levels and the Australian Standard AS2436:1981 *"Guide to Noise Control on Construction, Maintenance and Demolition Sites".*

Where applicable, the engineering and practical noise controls recommended in Section 7.1 have been incorporated into the predicted noise levels, i.e. enclosures around generators (-25 dB) and silencers on compressors (- 8 dB).

Knowing the sound power level of a noise source, the sound pressure level (as measured with a sound level meter) can be calculated at a remote location using suitable formulae to account for distance losses, barrier effects, etc.

Calculations consider distance attenuation, engineering and practical noise controls and attenuation provided by intervening structures (i.e. future educational buildings) only, with the range of levels based on the closest potential distance and furthest potential distance at which each item of plant may operate from each respective residential, educational, or industrial location. The calculated noise levels at nearby residential, educational, or industrial receptors for each are presented in the following Tables:

- Stage 1 – Tables 35 and 36;
- Stage 2 – Tables 37 and 38;
- Stage 3 – Tables 39 and 40; and
- Stage 4 – Tables 41 and 42.

8.1 Stage 1 – Noise Emissions – After Engineering and Practical Noise Controls

Following the implementation of engineering and practical noise controls recommended in Section 7.1, the level of noise exceedance during Stage 1 are presented below in Tables 35 and 36.

Table 35 Stage 1 - Calculated $L_{eq\ 15\ minute}$ Noise Levels (With Noise Controls) – R1 to R6

Description	Calculated Noise Levels (dBA)					
	R1	R2	R3	R4	R5	R6
Phase 1 – Demolition Works						
Demolition Works	57 – 80	50 – 57	50 – 59	55 – 80	56 – 80	57 – 80
Rock Hammering	63 – 86	56 – 63	56 – 65	61 – 86	62 – 86	63 – 86
Noise Management Level	46	46	75	46	46	46
Exceedance	**Up to 40 dB**	**Up to 17 dB**	**No**	**Up to 40 dB**	**Up to 40 dB**	**Up to 40 dB**
Phase 2 – Excavation Works						
Excavation Works	55 – 79	48 – 55	48 – 57	53 – 79	54 – 79	55 – 79
Rock Hammering	63 – 86	56 – 63	56 – 65	61 – 86	62 – 86	63 – 86
Noise Management Level	46	46	75	46	46	46
Exceedance	**Up to 40 dB**	**Up to 17 dB**	**No**	**Up to 40 dB**	**Up to 40 dB**	**Up to 40 dB**
Phase 3 – Construction						
Construction Works	58 – 68	50 – 51	51 – 52	55 – 59	57 – 62	58 – 68
Noise Management Level	46	46	75	46	46	46
Exceedance	**Up to 22 dB**	**Up to 5 dB**	**No**	**Up to 13 dB**	**Up to 16 dB**	**Up to 22 dB**

Table 36 Stage 1 - Calculated $L_{eq\ 15\ minute}$ Noise Levels (With Noise Controls) – R7 to R11

Description	Calculated Noise Levels (dBA)				
	R7	R8	R9	R10	R11
Phase 1 – Demolition Works					
Demolition Works	56 – 80	53 – 73	53 – 74	53 – 74	53 – 71
Rock Hammering	62 – 86	59 – 79	59 – 80	59 – 80	59 – 77
Noise Management Level	46	46	46	46	46
Exceedance	**Up to 40 dB**	**Up to 33 dB**	**Up to 34 dB**	**Up to 34 dB**	**Up to 31 dB**
Phase 2 – Excavation Works					
Excavation Works	54 – 79	51 – 71	51 – 73	51 – 73	51 – 69
Rock Hammering	62 – 86	59 – 79	59 – 80	59 – 80	59 – 77
Noise Management Level	46	46	46	46	46
Exceedance	**Up to 40 dB**	**Up to 33 dB**	**Up to 34 dB**	**Up to 34 dB**	**Up to 31 dB**
Phase 3 – Construction					
Construction Works	59 – 81	60 – 73	61 – 74	63 – 74	60 – 73
Noise Management Level	46	46	46	46	46
Exceedance	**Up to 35 dB**	**Up to 27 dB**	**Up to 28 dB**	**Up to 28 dB**	**Up to 27 dB**

It can be seen from Tables 35 and 36 above, that following the implementation of engineering and practical noise controls recommended in Section 7.1 the predicted levels of noise from construction activities will at times be in excess of the noise management levels of 46 dBA at residential receptor locations. There is also potential for the highly noise affected level of 75 dBA to be exceeded at ‘R1’ and ‘R4’ to ‘R11’ during the construction phases.

To minimise the noise impact from the construction activities we recommend that the noise controls and the management plan detailed in Section 7 of this report be implemented.

Rock hammering is not considered cumulatively as it is unknown at this stage whether it will be required, and if so where it may be required. To include it in the cumulative noise predictions would potentially over-state the predicted impact. However, as a precaution, it is recommended in the noise management controls (Section 7.2) that in the event that rock hammering is required near to residential receptors, it is conducted in the absence of any other plant operations to avoid a cumulative noise impact.

8.2 Stage 2 – Noise Emissions – After Engineering and Practical Noise Controls

Following the implementation of engineering and practical noise controls recommended in Section 7.1, the level of noise exceedance during Stage 2 are presented below in Tables 37 and 38.

Table 37 Stage 2 - Calculated $L_{eq\ 15\ minute}$ Noise Levels (With Noise Controls) – R1 to R6

Description	Calculated Noise Levels (dBA)					
	R1	R2	R3	R4	R5	R6
Phase 2 – Excavation Works						
Excavation Works	56 – 60	47 – 51	48 – 53	53 – 67	55 – 74	57 – 79
Rock Hammering	64 – 68	55 – 59	56 – 61	61 – 75	63 – 82	64 – 86
Noise Management Level	46	46	75	46	46	46
Exceedance	**Up to 22 dB**	**Up to 13 dB**	**No**	**Up to 29 dB**	**Up to 36 dB**	**Up to 40 dB**
Phase 3 – Construction						
Construction Works	59 – 63	50 – 54	51 – 55	56 – 70	57 – 77	59 – 81
Noise Management Level	46	46	75	46	46	46
Exceedance	**Up to 17 dB**	**Up to 8 dB**	**No**	**Up to 24 dB**	**Up to 31 dB**	**Up to 35 dB**

Table 38 Stage 2 – Calculated $L_{eq\ 15\ minute}$ Noise Levels (With Noise Controls) – R7 to RE

Description	Calculated Noise Levels (dBA)					
	R7	R8	R9	R10	R11	RE
Phase 2 – Excavation Works						
Excavation Works	58 – 79	55 – 70	45 – 71	44 – 71	43 – 70	58 – 79
Rock Hammering	65 – 86	63 – 78	53 – 79	52 – 79	51 – 78	66 – 86
Noise Management Level	46	46	46	46	46	65
Exceedance	**Up to 40 dB**	**Up to 32 dB**	**Up to 33 dB**	**Up to 33 dB**	**Up to 32 dB**	**Up to 21 dB**
Phase 3 – Construction						
Construction Works	60 – 81	58 – 73	47 – 74	47 – 74	46 – 73	61 – 81
Noise Management Level	46	46	46	46	46	65
Exceedance	**Up to 35 dB**	**Up to 27 dB**	**Up to 28 dB**	**Up to 28 dB**	**Up to 27 dB**	**Up to 16 dB**

It can be seen from Tables 37 and 38 above, that following the implementation of engineering and practical noise controls recommended in Section 7.1 that the predicted levels of noise from construction activities will at times be in excess of the noise management levels of 46 dBA at residential receptor locations and 65 dBA at educational receptor locations. There is also potential for the highly noise affected level of 75 dBA to be exceeded at 'R4' to 'R11' during the construction phases.

To minimise the noise impact from the construction activities we recommend that the noise controls and the management plan detailed in Section 7 of this report be implemented.

Rock hammering is not considered cumulatively as it is unknown at this stage whether it will be required, and if so where it may be required. To include it in the cumulative noise predictions would potentially over-state the predicted impact. However, as a precaution, it is recommended in the noise management controls (Section 7.2) that in the event that rock hammering is required near to residential or educational receptors, it is conducted in the absence of any other plant operations to avoid a cumulative noise impact.

8.3 Stage 3 – Noise Emissions – After Engineering and Practical Noise Controls

Following the implementation of engineering and practical noise controls recommended in Section 7.1, the level of noise exceedance during Stage 3 are presented below in Tables 39 and 40.

Table 39 Stage 3 - Calculated $L_{eq\ 15\ minute}$ Noise Levels (With Noise Controls) – R1 to R6

Description	Calculated Noise Levels (dBA)					
	R1	**R2**	**R3**	**R4**	**R5**	**R6**
Phase 2 – Excavation Works						
Excavation Works	55 – 76	48 – 55	49 – 56	45 – 76	46 – 76	45 – 76
Rock Hammering	63 – 84	56 – 63	57 – 64	52 – 84	54 - 84	53 – 84
Noise Management Level	46	46	75	46	46	46
Exceedance	**Up to 38 dB**	**Up to 17 dB**	**No**	**Up to 38 dB**	**Up to 38 dB**	**Up to 38 dB**
Phase 3 – Construction						
Construction Works	58 – 79	51 – 57	52 – 59	47 – 79	49 – 79	48 – 79
Noise Management Level	46	46	75	46	46	46
Exceedance	**Up to 33 dB**	**Up to 11 dB**	**No**	**Up to 33 dB**	**Up to 33 dB**	**Up to 33 dB**

Table 40 Stage 3 - Calculated $L_{eq\ 15\ minute}$ Noise Levels (With Noise Controls) – R7 to RE

Description	Calculated Noise Levels (dBA)					
	R7	R8	R9	R10	R11	RE
Phase 2 – Excavation Works						
Excavation Works	43 – 64	41 – 62	41 – 63	41 – 58	41 – 63	59 – 82
Rock Hammering	50 – 71	49 – 70	49 – 71	49 – 66	49 – 70	66 – 90
Noise Management Level	46	46	46	46	46	65
Exceedance	**Up to 25 dB**	**Up to 24 dB**	**Up to 25 dB**	**Up to 20 dB**	**Up to 24 dB**	**Up to 25 dB**
Phase 3 – Construction						
Construction Works	45 – 66	44 – 64	44 – 66	44 – 61	44 – 65	61 – 85
Noise Management Level	46	46	46	46	46	65
Exceedance	**Up to 20 dB**	**Up to 18 dB**	**Up to 20 dB**	**Up to 15 dB**	**Up to 19 dB**	**Up to 20 dB**

It can be seen from Tables 39 and 40 above, that following the implementation of engineering and practical noise controls recommended in Section 7.1 that the predicted levels of noise from construction activities will at times be in excess of the noise management levels of 46 dBA at residential receptor locations and 65 dBA at educational receptor locations. There is also potential for the highly noise affected level of 75 dBA to be exceeded at 'R1' and 'R4' to 'R6' during the construction phases.

To minimise the noise impact from the construction activities we recommend that the noise controls and the management plan detailed in Section 7 of this report be implemented.

Rock hammering is not considered cumulatively as it is unknown at this stage whether it will be required, and if so where it may be required. To include it in the cumulative noise predictions would potentially over-state the predicted impact. However, as a precaution, it is recommended in the noise management controls (Section 7.2) that in the event that rock hammering is required near to residential receptors, it is conducted in the absence of any other plant operations to avoid a cumulative noise impact.

8.4 Stage 4 – Noise Emissions – After Engineering and Practical Noise Controls

Following the implementation of engineering and practical noise controls recommended in Section 7.1, the level of noise exceedance during Stage 4 are presented below in Tables 41 and 42.

Table 41 Stage 4 - Calculated $L_{eq\ 15\ minute}$ Noise Levels (With Noise Controls) – R1 to R6

Description	Calculated Noise Levels (dBA)					
	R1	R2	R3	R4	R5	R6
Phase 2 – Excavation Works						
Excavation Works	62 – 71	50 – 51	51 – 52	48 – 62	54 – 64	48 – 53
Rock Hammering	70 – 79	58 – 59	59 – 60	55 – 70	62 – 72	56 – 61
Noise Management Level	46	46	75	46	46	46
Exceedance	**Up to 33 dB**	**Up to 13 dB**	**No**	**Up to 24 dB**	**Up to 26 dB**	**Up to 15 dB**
Phase 3 – Construction						
Construction Works	64 – 74	53 – 54	54 – 55	50 – 65	57 – 67	51 – 56
Noise Management Level	46	46	75	46	46	46
Exceedance	**Up to 28 dB**	**Up to 8 dB**	**No**	**Up to 19 dB**	**Up to 21 dB**	**Up to 10 dB**

Table 42 Stage 4 - Calculated $L_{eq\ 15\ minute}$ Noise Levels (With Noise Controls) – R7 to RE

Description	Calculated Noise Levels (dBA)					
	R7	**R8**	**R9**	**R10**	**R11**	**RE**
Phase 2 – Excavation Works						
Excavation Works	45 – 49	44 – 46	44 – 46	45 – 47	50 – 57	67 – 82
Rock Hammering	53 – 56	52 – 54	52 – 54	53 – 54	57 – 65	74 – 90
Noise Management Level	46	46	46	46	46	65
Exceedance	**Up to 10 dB**	**Up to 8 dB**	**Up to 8 dB**	**Up to 8 dB**	**Up to 19 dB**	**Up to 25 dB**
Phase 3 – Construction						
Construction Works	48 – 51	47 – 49	47 – 49	47 – 49	52 – 60	69 – 85
Noise Management Level	46	46	46	46	46	65
Exceedance	**Up to 5 dB**	**Up to 3 dB**	**Up to 3 dB**	**Up to 3 dB**	**Up to 14 dB**	**Up to 20 dB**

It can be seen from Tables 41 and 42 above, that following the implementation of engineering and practical noise controls recommended in Section 7.1 that the predicted levels of noise from construction activities will at times be in excess of the noise management levels of 46 dBA at residential receptor locations and 65 dBA at educational receptor locations. There is also potential for the highly noise affected level of 75 dBA to be exceeded at 'R1' during the construction phases.

To minimise the noise impact from the construction activities we recommend that the noise controls and the management plan detailed in Section 7 of this report be implemented.

Rock hammering is not considered cumulatively as it is unknown at this stage whether it will be required, and if so where it may be required. To include it in the cumulative noise predictions would potentially over-state the predicted impact. However, as a precaution, it is recommended in the noise management controls (Section 7.2) that in the event that rock hammering is required near to residential receptors, it is conducted in the absence of any other plant operations to avoid a cumulative noise impact.

9.0 CONCLUSION

Day Design Pty Ltd has been engaged by Midson Group on behalf of Minarah College to prepare a Construction Noise and Vibration Management Plan for the proposed new education campus to be known as Minarah College Catherine Field at 268-278 Catherine Fields Road, Catherine Field, NSW.

Provided the recommendations in Section 7 of this report are implemented, the level of noise and vibration from the construction works at Minarah College Catherine Field, 268-278 Catherine Fields Road, Catherine Field, NSW will be minimised as far as reasonably practical in accordance with the Australian Standard AS2436:2010 *"Guide to noise and vibration control on construction, demolition and maintenance sites"* and the EPA's *Interim Construction Noise Guideline 2009* and *Assessing Vibration: a technical guideline 2006*, as detailed in Section 5 of this report.

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Senior Acoustical Consultant
for and on behalf of Day Design Pty Ltd

AAAC MEMBERSHIP

Day Design Pty Ltd is a member company of the Association of Australasian Acoustical Consultants, and the work herein reported has been performed in accordance with the terms of membership.

APPENDICES

- Appendix A – Noise Survey Instrumentation
- Appendix B1 to B4 – Ambient Noise Surveys
- Appendix C – Staging Plan
- AC108 – Glossary of Acoustical Terms

NOISE SURVEY INSTRUMENTATION

Noise level measurements and analysis in this report were made with instrumentation as follows:

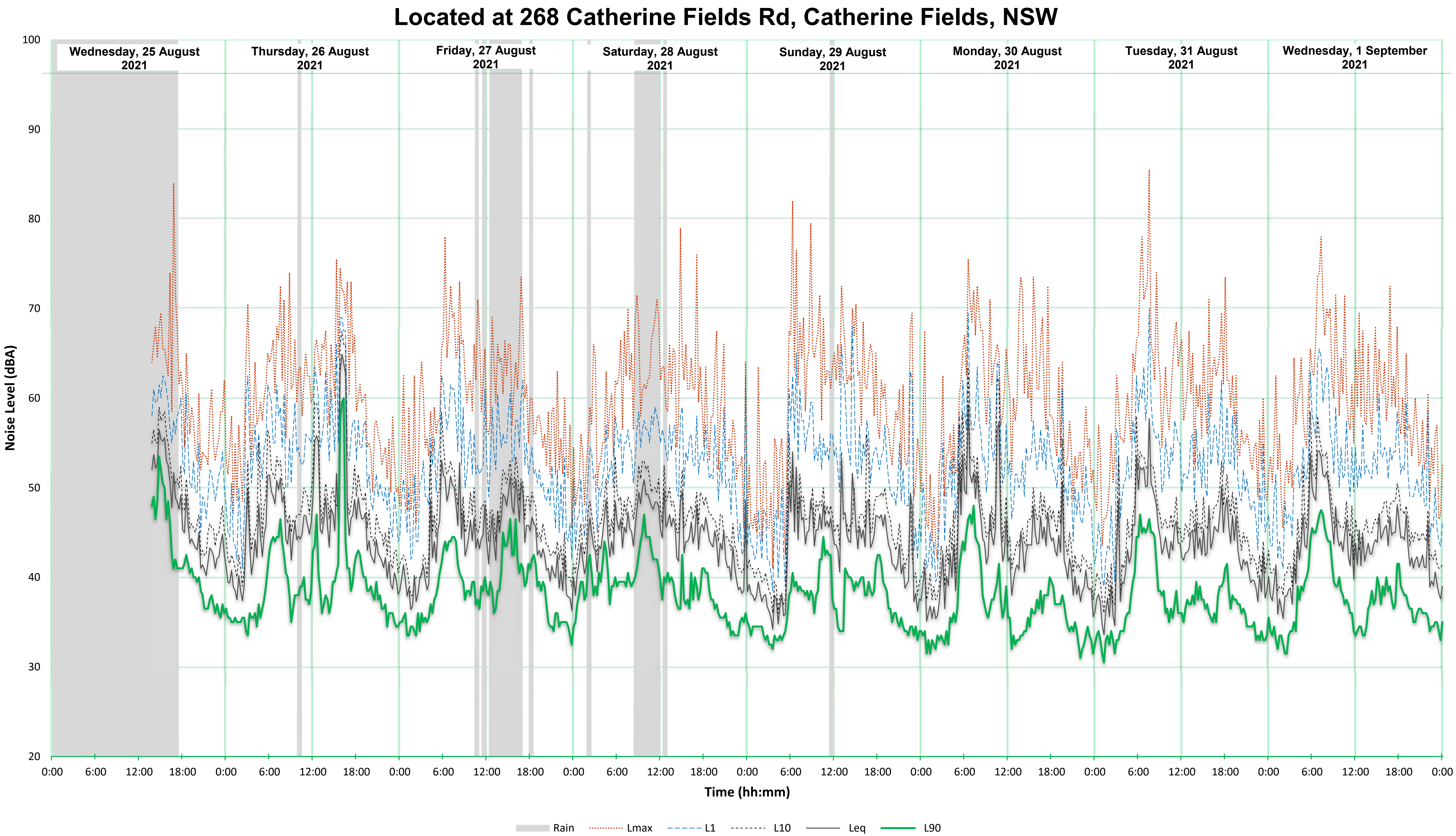
Table A1 Noise Survey Instrumentation

Description	Model No	Serial No
Infobyte Noise Logger (Type 1) Condenser Microphone 0.5" diameter	iM4 MK 250	103 7371
Infobyte Noise Logger (Type 1) Condenser Microphone 0.5" diameter	iM4 MK 250	105 7112
Infobyte Noise Logger (Type 2) Condenser Microphone 0.5" diameter	iM4 MK 250	123 123

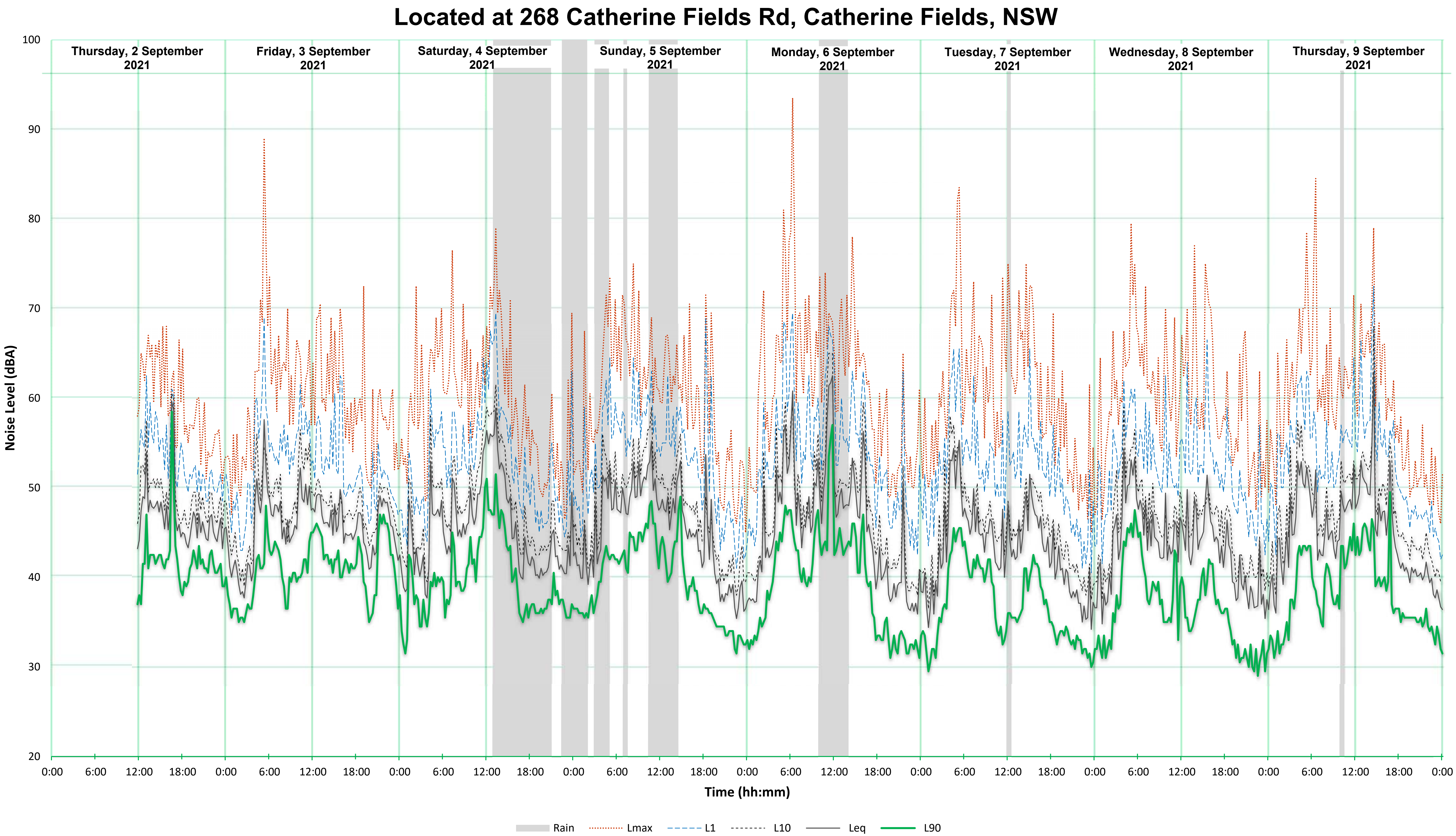
An environmental noise logger is used to continuously monitor ambient noise levels and provide information on the statistical distribution of noise during an extended period of time. The Infobyte Noise Monitor iM4s are a Type 1 or 2 precision environmental noise monitor meeting all the applicable requirements of AS1259 for an integrating-averaging sound level meter.

All instrument systems had been laboratory calibrated using instrumentation traceable to Australian National Standards and certified within the last two years thus conforming to Australian Standards. The measurement system was also field calibrated prior to and after noise surveys. Calibration drift was found to be less than 1 dB during unattended measurements. No adjustments for instrument drift during the measurement period were warranted.

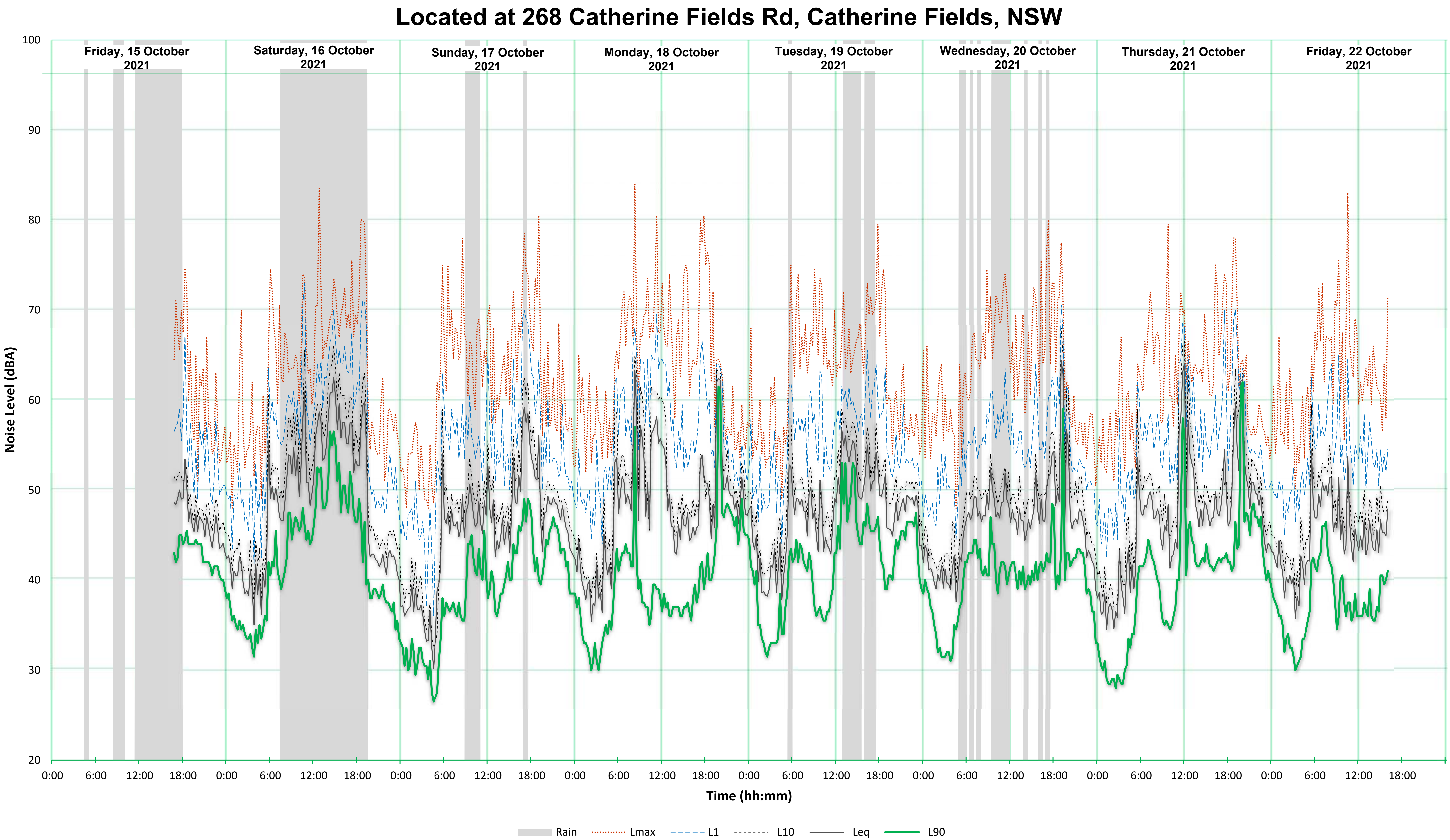
AMBIENT NOISE SURVEY



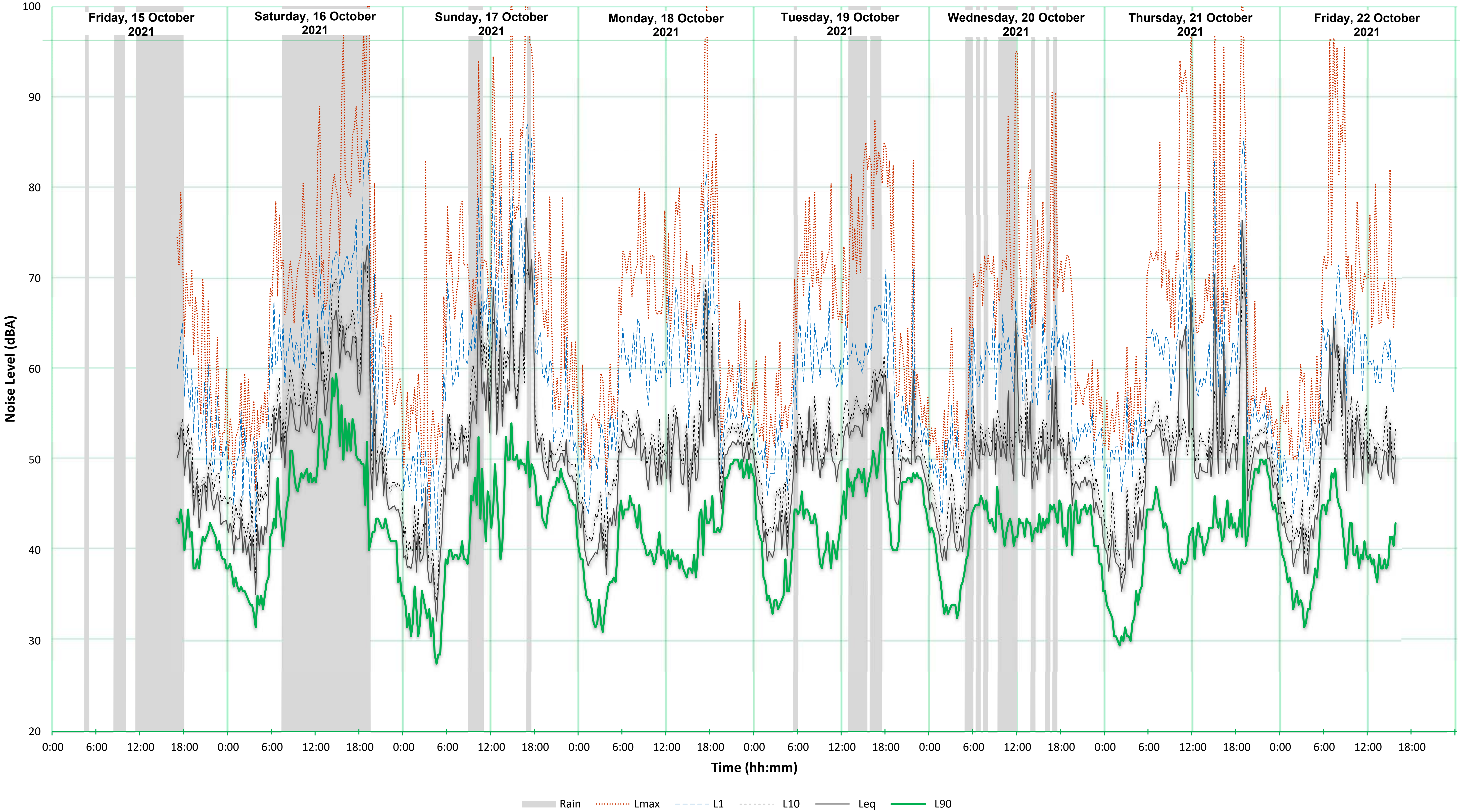
AMBIENT NOISE SURVEY



AMBIENT NOISE SURVEY



Located at 278 Catherine Fields Rd, Catherine Fields, NSW



DATE	REV	DESCRIPTION:
31/03/22	A	ISSUE FOR SSDA
19/03/24	B	AMENDED ISSUE FOR SSDA
21/05/24	C	AMENDED ISSUE FOR SSDA

NOTES:
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SCALE 1:500
2.5 0m 5 10 20

PROJECT : MINARAH COLLEGE
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PROJECT NO : #21019

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DRAWING TITLE: STAGING PLAN
SCALES: 1:500
PHASE: AMENDED SSDA
DRAWING NO: A 004
DRAWN BY: BS, RL, JD, WR
CHECKED: PT
DATE: 24.06.2024
REV: C

ACOUSTICAL – Pertaining to the science of sound, including the generation, propagation, effects and control of both noise and vibration.

AMBIENT NOISE – The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, both near and far, including road traffic, factories, wind in the trees, birds, insects, animals, etc.

AUDIBLE – means that a sound can be heard. However, there are a wide range of audibility grades, varying from "barely audible" to "just audible", "clearly audible" and "prominent". Chapter 83 of the NSW Environment Protection Authority – Environmental Noise Control Manual (1985) states:

"noise from a particular source might be offensive if it is clearly audible, distinct from the prevailing background noise and of a volume or character that a reasonable person would be conscious of the intrusion and find it annoying or disruptive".

It follows that the word "audible" in an environmental noise context means "clearly audible".

BACKGROUND NOISE LEVEL – Silence does not exist in the natural or the built-environment, only varying degrees of noise. The Background Noise Level is the average minimum dBA level of noise measured in the absence of the noise under investigation and any other short-term noises such as those caused by cicadas, lawnmowers, etc. It is quantified by the L_{A90} or the dBA noise level that is exceeded for 90 % of the measurement period (usually 15 minutes).

- **Assessment Background Level (ABL)** is the single figure background level representing each assessment period – day, evening and night (ie three assessment background levels are determined for each 24hr period of the monitoring period). Determination of the assessment background level is by calculating the tenth percentile (the lowest tenth percent value) of the background levels (L_{A90}) for each period (refer: NSW Industrial Noise Policy, 2000).
- **Rating Background Level (RBL)** as specified by the Environment Protection Authority is the overall single figure (L_{A90}) background noise level representing an assessment period (day, evening or night) over a monitoring period of (normally) three to seven days.

  The RBL for an assessment period is the median of the daily lowest tenth percentile of L_{90} background noise levels.

  If the measured background noise level is less than 30 dBA, then the Rating Background Level (RBL) is considered to be 30 dBA.

DECIBEL – The human ear has a vast sound-sensitivity range of over a thousand billion to one. The decibel is a logarithmic unit that allows this same range to be compressed into a somewhat more comprehensible range of 0 to 120 dB. The decibel is ten times the logarithm of the ratio of a sound level to a reference sound level. See also Sound Pressure Level and Sound Power Level.

Decibel noise levels cannot be added arithmetically since they are logarithmic numbers. If one machine is generating a noise level of 50 dBA, and another similar machine is placed beside it, the level will increase to 53 dBA, not 100 dBA. Ten similar machines placed side by side increase the sound level by 10 dBA, and one hundred machines increase the sound level by 20 dBA.

dBA – The human ear is less sensitive to low frequency sound than high frequency sound. We are most sensitive to high frequency sounds, such as a child's scream. Sound level meters have an inbuilt weighting network, termed the dBA scale, that approximates the human loudness response at quiet sound levels (roughly approximates the 40 phon equal loudness contour).

However, the dBA sound level provides a poor indication of loudness for sounds that are dominated by low frequency components (below 250 Hz). If the difference between the "C" weighted and the "A" weighted sound level is 15 dB or more, then the NSW Industrial Noise Policy recommends a 5 dBA penalty be applied to the measured dBA level.

dBC – The dBC scale of a sound level meter is similar to the dBA scale defined above, except that at high sound intensity levels, the human ear frequency response is more linear. The dBC scale approximates the 100 phon equal loudness contour.

EQUIVALENT CONTINUOUS NOISE LEVEL, L_{Aeq} – Many noises, such as road traffic or construction noise, vary continually in level over a period of time. More sophisticated sound level meters have an integrating electronic device inbuilt, which average the A weighted sound pressure levels over a period of time and then display the energy average or L_{Aeq} sound level. Because the decibel scale is a logarithmic ratio the higher noise levels have far more sound energy, and therefore the L_{Aeq} level tends to indicate an average which is strongly influenced by short term, high level noise events. Many studies show that human reaction to level-varying sounds tends to relate closely to the L_{Aeq} noise level.

FREE FIELD – This is a sound field not subject to significant reflection of acoustical energy. A free field over a reflecting plane is usually outdoors with the noise source resting on hard flat ground, and not closer than 6 metres to any large flat object such as a fence or wall; or inside an anechoic chamber.

FREQUENCY – The number of oscillations or cycles of a wave motion per unit time, the SI unit being the Hertz, or one cycle per second.

IMPACT ISOLATION CLASS (IIC) – The American Society for Testing and Materials (ASTM) has specified that the IIC of a floor/ceiling system shall be determined by operating an ISO 140 Standard Tapping Machine on the floor and measuring the noise generated in the room below. The IIC is a number found by fitting a reference curve to the measured octave band levels and then deducting the sound pressure level at 500 Hz from 110 decibels. Thus the higher the IIC, the better the impact sound isolation.

IMPACT SOUND INSULATION ($L_{nT,w}$) – Australian Standard AS ISO 717.2 – 2004 has specified that the Impact Sound Insulation of a floor/ceiling system be quantified by operating an ISO 140 Standard Tapping Machine on the floor and measuring the noise generated in the room below. The Weighted Standardised Impact Sound Pressure Level ($L_{nT,w}$) is the sound pressure level at 500 Hz for a reference curve fitted to the measured octave band levels. Thus the lower $L_{nT,w}$ the better the impact sound insulation.

IMPULSE NOISE – An impulse noise is typified by a sudden rise time and a rapid sound decay, such as a hammer blow, rifle shot or balloon burst.

INTRUSIVE NOISE LEVEL, L_{Aeq} – The level of noise from a factory, place of entertainment, etc. in NSW is assessed on the basis of the average maximum noise level, or the $L_{Aeq\ (15\ min)}$. This is the energy average A weighted noise level measured over any 15 minute period.

LOUDNESS – The degree to which a sound is audible to a listener is termed the loudness. The human ear perceives a 10 dBA noise level increase as a doubling of loudness and a 20 dBA noise increase as a quadrupling of the loudness.

MAXIMUM NOISE LEVEL, L_{Amax} – The rms maximum sound pressure level measured on the "A" scale of a sound level meter during a noise survey is the L_{Amax} noise level. It may be measured using either the Fast or Slow response time of the meter. This should be stated.

NOISE RATING NUMBERS – A set of empirically developed equal loudness curves has been adopted as Australian Standard AS1469-1983. These curves allow the loudness of a noise to be described with a single NR number. The Noise Rating number is that curve which touches the highest level on the measured spectrum of the subject noise. For broadband noise such as fans and engines, the NR number often equals the dBA level minus five.

NOISE – Noise is unwanted sound. Sound is wave motion within matter, be it gaseous, liquid or solid. "Noise includes sound and vibration".

NOISE REDUCTION COEFFICIENT – See: "Sound Absorption Coefficient".

OFFENSIVE NOISE - (Reference: Dictionary of the Protection of the Environment Operations Act 1997). *"Offensive Noise means noise:*

(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

  (i) is harmful to (or likely to be harmful to) a person who is outside the premise from which it is emitted, or

  (ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances prescribed by the regulations."

PINK NOISE – Pink noise is a broadband noise with an equal amount of energy in each octave or third octave band width. Because of this, Pink Noise has more energy at the lower frequencies than White Noise and is used widely for Sound Transmission Loss testing.

REVERBERATION TIME, T_{60} – The time in seconds, after a sound signal has ceased, for the sound level inside a room to decay by 60 dB. The first 5 dB decay is often ignored, because of fluctuations that occur while reverberant sound conditions are being established in the room. The decay time for the next 30 dB is measured and the result doubled to determine the T_{60}. The Early Decay Time (EDT) is the slope of the decay curve in the first 10 dB normalised to 60 dB.

SOUND ABSORPTION COEFFICIENT, α – α Sound is absorbed in porous materials by the viscous conversion of sound energy to heat energy as the sound waves pass through it. Sound is similarly absorbed by the flexural bending of internally damped panels. The fraction of incident energy that is absorbed is termed the Sound Absorption Coefficient, α. An absorption coefficient of 0.9 indicates that 90 % of the incident sound energy is absorbed. The average α from 250 to 2000 Hz is termed the Noise Reduction Coefficient (NRC).

SOUND ATTENUATION – If an enclosure is placed around a machine, or a silencer is fitted to a duct, the noise emission is reduced or attenuated. An enclosure that attenuates the noise level by 30 dBA, reduces the sound energy by one thousand times.

SOUND EXPOSURE LEVEL (SEL) – The total sound energy of a single noise event condensed into a one second duration or in other words it is an L_{eq} (1 sec).

SOUND PRESSURE LEVEL, L_p – The level of sound measured on a sound level meter and expressed in decibels, dB, dBA, dBC, etc. $L_p = 20 \times \log (P/P_o)$ ... dB

where P is the rms sound pressure in Pascal and P_o is a reference sound pressure of 20 μPa. L_p varies with distance from a noise source.

SOUND POWER LEVEL, L_w – The Sound Power Level of a noise source is an absolute that does not vary with distance or with a different acoustic environment.

$L_w = L_p + 10 \log A$ ... dB, re: 1pW,
where A is the measurement noise-emission area in square metres in a free field.

SOUND TRANSMISSION CLASS (STC) – An internationally standardised method of rating the sound transmission loss of partition walls to indicate the decibels of noise reduction of a human voice from one side to the other. (Refer: Australian Standard AS1276 – 1979)

SOUND TRANSMISSION LOSS – The amount in decibels by which a random sound is reduced as it passes through a sound barrier. A method for the measurement of airborne Sound Transmission Loss of a building partition is given in Australian Standard AS1191 - 2002.

STATISTICAL EXCEEDENCE SOUND LEVELS, L_{A90}, L_{A10}, L_{A1}, etc – Noise which varies in level over a specific period of time (usually 15 minutes) may be quantified in terms of various statistical descriptors:

The L_{A90} is the dBA level exceeded for 90 % of the time. In NSW the L_{A90} is measured over periods of 15 minutes, and is used to describe the average minimum or background noise level.

The L_{A10} is the dBA level that is exceeded for 10 % of the time. In NSW the L_{A10} measured over a period of 10 to 15 minutes. It was until recently used to describe the average maximum noise level, but has largely been replaced by the L_{Aeq} for describing level-varying noise.

The L_{A1} is the dBA level that is exceeded for 1 % of the time. In NSW the L_{A1} may be used for describing short-term noise levels such as could cause sleep arousal during the night.

STEADY NOISE – Noise, which varies in level by 6 dBA or less, over the period of interest with the time-weighting set to "Fast", is considered to be "steady". (Refer AS 1055.1 1997)

WEIGHTED SOUND REDUCTION INDEX, R_w – This is a single number rating of the airborne sound insulation of a wall, partition or ceiling. The sound reduction is normally measured over a frequency range of 100 to 3,150 Hertz and averaged in accordance with ISO standard weighting curves (Refer AS/NZS 1276.1:1999).

Internal partition wall R_w + C ratings are frequency weighted to simulate insulation from human voice noise. The R_w + C is always similar in value to the STC rating value. External walls, doors and windows may be $R_w + C_{tr}$ rated to simulate insulation from road traffic noise. This is normally a lower number than the STC rating value.

WHITE NOISE – White noise is broadband random noise whose spectral density is constant across its entire frequency range. The sound power is the same for equal bandwidths from low to high frequencies. Because the higher frequency octave bands cover a wider spectrum, white noise has more energy at the higher frequencies and sounds like a hiss.